

Netværk for kvinder i fysik

Nyhedsbrev nr. 25

Oktober 2000

Kære netværksmedlemmer!

Dette nyhedsbrev indeholder referat af generalforsamlingen, der som bekendt fandt sted i forbindelse med årsmødet den 7. juni 2000.

Derudover har vi som sædvanlig noget om bestyrelsens planer om aktiviteter det næste stykke tid, og udklip af forskellig art, bl.a. om den stadige lønforskel mellem mænd og kvinder i Danmark og et udklip om positiv særbehandling. Derudover har vi to portrætter: et af Lene Vestergaard Hau, som i parentes bemærket har udtrykt vilje til at tale ved et kommende KIF årsmøde når det ellers kan komme til at passe ind i hendes travle program, og et af vores formand, Anja Andersen. Endelig har vi valgt at bringe lidt udklip fra "den store verden" om det at være kvinde indenfor de hårde naturvidenskaber.

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Nyt fra bestyrelsen

Siden sidste nyhedsbrev har vi holdt et godt og konstruktivt bestyrelsesmøde også med deltagelse af nogle af de nye i bestyrelsen. Af vigtige programpunkter var promoveringen af KIF, evt. i forbindelse med en promovering af DFS, plakat-initiativer samt hjemmeside med medlemmer, hvor de forskelliges ekspertise og interesseområder lægges frem.

Et lille underudvalg i bestyrelsen bestående af Eva Danielsen, Mia Stampe og Stine Nyborg Klausen vil i løbet af efteråret arbejde med ideer til layout til en sådan hjemmeside. De af KIF's medlemmer, der måtte ønske at stå på en sådan hjemmeside (mange i flg. spørgeskemaundersøgelsen) vil få opfordringen i et kommende nyhedsbrev.

Besøg en arbejdsplads: Iskerner

Da medlemmerne i spørgeskema-undersøgelsen har udtrykt stor interesse for at deltage i lokale KIF arrangementer forsøger vi os nu med et: Vi har lavet en aftale om et "gå-i-byen" arrangement, hvor Marie-Louise Siggaard Andersen vil vise os rundt i glaciologernes frysekælder og hun og måske også Katrine Krogh Andersen vil fortælle om deres arbejde i forbindelse med iskernerne der. Arrangementet forventes at blive afholdt **d. 25/10** (men kan potentielt flyttes til 23/10) og er selvfølgelig også åbent for mænd. Formatet for arrangementet bliver ca. 1.5 times rundvisning/foredrag efterfulgt af en fælles spising på en af arrangørerne udvalgt restaurant. Starttidspunkt ca. kl. 17.

Hvis ovenstående har fanget din interesse kan du melde dig til arrangementets "email-liste" ved at sende en email til Henriette snarest (hj@mic.dtu.dk)!! Når vi nærmer os d. 25/10, vil du da modtage nærmere instruks om tid og sted. Hvis du skulle foretrække at arrangementet afholdes d. 23/10, bedes du **hurtigst muligt** skrive det i din email til Henriette.

Allan Mackintosh legatet

Den 11/9 blev Allan Mackintosh' formidlingspris tildelt vores formand, Anja Andersen. Et stort tillykke fra nyhedsbredsredaktørerne!! Et eksempel på at Anja er en værdig modtager af legatet (hvis I ikke allerede vidste det!) kan ses i portrættet på side 14-16 i dette nyhedsbrev.

Referat af generalforsamlingen 7/6 2000

Generalforsamlingen afholdtes efter årsmødet med flg. dagsorden:

1. Valg af dirigent
2. Valg af referent
3. Formandens beretning
4. Valg af ny bestyrelse
5. Forslag fra medlemmer og bestyrelse
6. Evt.

ad 1 Bodil Helt blev valgt, og konstaterede at generalforsamlingen var lovlig indkaldt og beslutningsdygtig.

ad 2 Kirstine Berg-Sørensen blev valgt.

ad 3 Formanden aflagde beretningen. Beretningen er trykt på de næste sider.

ad 4 2 af bestyrelsens medlemmer ønskede ikke at fortsætte, nemlig Maryanne Kmit og Therese Moretto. Halvdelen af de resterende i bestyrelsen, nemlig formanden Anja Andersen, Henriette Jensenius, Liv Hornekær, og Kirstine Berg-Sørensen vil i det kommende år være en del i udlandet, eller ønsker at skrue ned for indsatsen i KIF's bestyrelse, derfor var der hårdt brug for nye kræfter! 4 nye medlemmer blev valgt til bestyrelsen: Winnie Svendsen (Ørsted Laboratoriet, Københavns Universitet), Marie Jensen (Institut for Fysik og Astronomi, Århus Universitet), Stine Nyborg Klausen (Risø), og Tina Christensen (Danmark Meteorologiske Institut). Derudover kom Ling Miao (Fysik, Syddansk Universitet, Odense) på bestyrelsens email-liste.

ad 5 Ingen indkomne forslag

ad 6 I forlængelse af formandens beretning diskuteredes hvad vi evt. kunne gøre for at få nye medlemmer - og om der overhovedet skulle gøres noget.

Liv Hornekær oplyste, at hun havde givet alle kvindelige 2. dels studerende i Århus et nyhedsbrev samt 1 sides information om KIF og årsmødet i år. På Astronomi ved KU omtaler Bodil Helt netværket for samtlige kvindelige studerende, hun kommer i kontakt med. Ling Miao havde nævnt netværket for de kvindelige studerende i Odense. Der mangler pt. initiativer på de øvrige fysik-afdelinger ved Niels Bohr Institutet, på DTU, RUC - og Ålborg Universitet.

Pga. den reaktion nogle af de kvindelige studerende kommer med når netværket bliver nævnt, blev det fremført at det er vigtigt at netværket profilerer sig som en apolitisk forening. Netværkets formål er at synliggøre kvinder i fysik, og det kan åbenbart ikke siges tit nok at vi ikke "står for noget" politisk.

En måde at informere på vil være at få et indlæg i Kvant, som beskriver dette års KIF årsmøde, Lisbeth Kjeldgaard blev valgt til at skrive et sådant indlæg.

Derudover blev der talt om en evt. plakat, og dens indhold. I tråd med årsmødets oplæg fra Helene Sørensen og Henrik Busch var der et forslag om plakattitlen: "Mød en kvindelig fysiker". Det blev i den forbindelse diskuteret om vi skulle gøre noget ved ideen om en database med kvindelige fysikere som potentielle foredragsholdere. En sådan database kunne være tilgængelig fra KIF's hjemmeside (og vi kunne evt. sørge for at hjemmesiden bliver tilmeldt forskellige internet-søge-tjenester). I følge spørgeskemaundersøgelsen vil 40 af KIF's medlemmer gerne stå i en sådan database.

Endelig var der - igen i år - forslag om lokale foredrag/arrangementer, som måske kunne bidrage til at gøre kvindelige studerende opmærksomme på KIF's eksistens og "indhold".

Herefter takkede dirigenten for god ro og orden, og mødet blev hævet.

Se formandens beretning på næste side!

Sakset fra "Physics News" fra American Institute of Physics:

WOMEN IN PHYSICS. Girls now account for half of high school physics students in the US, but in general, participation of women in physics decreases with the years. In 1993, for example, girls represented two fifths of high school physics students; five years later women accounted for only one fifth of physics bachelor's degrees. The percentage of women PhDs in physics and engineering (about 13%) lags behind the percentages for math (25%) and chemistry (31%), and further still behind biology and medicine. (For more information, including lists of the top women physics bachelor granting universities, see the AIP report "Women in Physics, 2000"; www.aip.org/statistics)

Generalforsamling for Netværket for Kvinder i Fysik

Formandens beretning 2000:

Det forløbne år har bestyrelsesarbejdet primært drejet sig om at føre de ting ud i livet, som vi blev opfordret til ved sidste års generalforsamling, nemlig at foretage en medlemsrevidering.

Vi har således saneret medlemslisten ved at bede samtlige medlemmer om at gentilmelde sig hvis de fortsat ønskede at være medlemmer af netværket. Det har reduceret vores netværk med 1/3 – fra 134 medlemmer til 82 medlemmer. Det gode ved at vi er færre medlemmer er, at vi ikke spilder penge på at sende nyhedsbrevet ud til folk, som ikke gider at læse det – det ærgerlige er selvfølgelig, at det er sjovest at være rigtig mange.

Vi har også gjort os en del overvejelser i bestyrelsen omkring hvordan vi skal præsentere os for potentielle medlemmer. Skal vi f.eks. lave en plakat der kan hænges op rundt omkring på institutterne? Skal vi aktivt forsøge at hverve speciale-studerende? Skal vi skrive i KVANT? Eller skal vi sige at mund til mund metoden er den bedste og derfor ikke gøre noget aktivt for at få flere medlemmer? Lige nu gør vi ingenting. Medlemmer der melder sig ind i DFS får af vide at vi findes som en sektion. Vi har forsøgt at lave forslag til plakater, men det er strandet på at vi ikke kunne afgøre om det var besværet værd.

I bestyrelsen er vi meget glade for de bidrag som vi har fået fra medlemmerne omkring ”en dag i deres liv” og vi håber på at modtage mange flere bidrag. Derudover vil vi godt have lov at takke alle dem der ulejliget sig med at besvare vores spørgeskema så vi nu har en bedre fornemmelse af hvem vores medlemmer er. En ting som dog undrer mig er at 92.3% af jer mener, at vi skal lave vores egne arrangementer, mens at kun 70% af jer siger at I vil deltage i dem! Vi har pt. ingen planlagte arrangementer.

Der er 65% af medlemmerne, der ønsker at vi skal flytte vores årsmøde fra den efterhånden traditionelle onsdag til en lørdag (altså efter DFS mødet i stedet for før). Det vil vi arbejde for i bestyrelsen. Grunden til at det ikke er en lørdag i år (og heller ikke bliver det næste år) er fordi Hotel Nyborg Strand er bestilt flere år i forvejen til DFS arrangementet.

I år har vi for første gang været i den situation, at vi har haft flere der har spurgt om lov til at holde fordrag til vores årsmøde. Det har gjort at programmet er blevet noget mere presset end det plejer, i et forsøg på ikke at skulle afvise nogen. Så man kan måske sige at vi er ved at være en succes?

Vi har modtaget en forespørgsel fra *Foreningen for Kønsforskning i Danmark* om vi ikke kunne tænke os en form for samarbejde, hvor vi kan bruge hinanden. Foreløbig har jeg tænkt mig at deltage i deres arrangementer og undersøge om der er basis for en form for samarbejde.

Jeg har modtaget to invitationer til at deltage i konferencer omkring emnet ”Women in Science”. Det ene møde var et NGO møde i St. Petersborg. Det var en international conference ”devoted to the problems of women-scientists”. Jeg blev inviteret til at tale omkring emnet ”Reconciling work and family life”. Det andet møde var i EU regi og var et møde vedrørende hvordan man kan få flere kvinder til at interessere sig for EU’s 5. og 6. rammeprogram. EU vil gerne have at flere kvinder melder sig som ”referees” og at langt flere kvinder søger penge til forskningsprojekter. Deres mål er

at 40% af forskningsmidlerne skal gå til kvinder. Lige nu er de knap og nap oppe på 15%. Desværre måtte jeg melde afbud til begge konferencer idet jeg er på barselsorlov. Ingen andre i bestyrelsen havde tid til at deltage i stedet for. Jeg vil få tilsendt proceedings fra begge møder så jeg senere kan informere nærmere om hvad der kom ud af dem.

I resten af valgperioden vil Eva Danielsen fungere som formand for netværket, idet jeg vil befinde mig i udlandet. Jeg vil dog fortsætte i bestyrelsen og give mit besyv med per e-mail. Da jeg ikke vil læse helt så mange danske aviser i den periode vil jeg gerne opfordre jer alle til at sende det I falder over som I mener andre i netværket kunne have godt af læse.

Med venlig hilsen,

Anja Andersen

Plakat for KIF?

Som bebudet både i dette og forrige nyhedsbrev arbejder bestyrelsen på at lave en flot "hverve"-plakat for KIF. Vi kunne dog bruge ideer og input fra medlemmerne! Vi har pt. 2 ideer, som der kan arbejdes videre med, men hvis du har en fantastisk idé eller forslag til skitserne nedenfor, tøv ikke, kontakt det nærmeste bestyrelsesmedlem!!

Idé nr. 1: Tekst: HVAD LÅVER Kvinder I Fysik? Billede: 4 eksempler (med lidt tekst).

Evt. kunne vi her lave et antal forskellige plakater, så mere end 4 medlemmer kunne blive eksponeret.

Idé nr. 2: Tekst: Et enkelt (fagligt) spørgsmål (eks. hvor langsomt kan lys bevæge sig)

Tekst: Svar på spørgsmålet (citat "en kvindelig fysiker", eks. Lene Hau)

Tekst: læs mere på KIF's hjemmeside.

Lysets mester

Den danske fysiker Lene Vestergaard Hau har gjort international karriere. Men hvad kræver det, når en kvinde vil til tops i en mandsdomineret forskerverden?

Portræt

Af ROBIN ENGELHARDT

Det er ikke hver dag, man hører om opsigtsvækkende opdagelser fra fysikkens verden. Og det er heller ikke hver dag man hører, at det er en kvinde, der står bag. En dansk kvinde, 40 år, som har trodset alle odds og kønsroller for at vie sit liv til frontforskningen og en international karriere.

Lene Vestergaard Hau er navnet bag succesen. Hun opdagede i begyndelsen af sidste år, at lyset kan bremses ned til kun 61 kilometer i timen, hvilket er en hastighed, som er 20 millioner gange mindre, end den hastighed på 300.000 kilometer i sekundet, som Ole Rømer målte i 1676.

Efter opdagelsen fløj der pludselig utallige tilbud om professorstillinger og ærestitler ind ad brevsprækken på Lene Haus lejlighed i Boston. Hvad der oprindeligt skulle være et to-årigt ophold i USA, er for Lene Hau efterhånden blevet til elleve år. For nylig sagde hun ja til en stilling på Harvard, og det bliver helt sikkert til endnu flere år i fronten af den amerikanske forskning.

Danmark, familie og venner ser Lene Hau kun en gang imellem, og der har heller ikke været tid til at stifte egen familie i USA.

»For mig har det været et valg. Jeg har valgt at være her i laboratoriet, og jeg arbejder ekstremt hårdt – nogle gange nat og dag – og det sætter jo en naturlig grænse for, hvad man kan lave udenfor arbejdet,« siger Lene Hau.

Men for hende har det

været et lykkeligt valg. Følelsen af at være tæt på livets mysterier, at kunne aflure naturens inderste hemmeligheder, og – når man en gang imellem er heldig – at opdage helt nye fænomener, som intet andet menneske har set før: Det opvejer alle de lange og ensomme nattetimer med »pepperonipizza og kaffe i laboratoriet.«

Bedre end mænd

Fysikkens »superlige« har kun sjældent været besøgt af kvindelige forskere. Når det skete, var det som regel, fordi de var de allerbedste. Lene Hau fortæller, hvordan man som kvinde i et så mandsdomineret fag som fysik skal presse på for at få sine ting igennem. Mere end mændene. Og man skal helst også være bedre end dem for at kunne bestride den samme stilling.

Ansættelser på universitetet foregår i sagens natur på en problematisk måde, mener Lene Hau: »Der er jo i grunden et mandligt netværk, og en kvinde er svær at definere som forsker. En mand føles som et velkendt begreb – man ved, hvad man kan forvente, og han har den rette jargon.«

Heller ikke dagligdagen er uden problemer af den art. Som eksempel fortæller Hau en historie om en tekniker på Rowland Instituttet, hvor hun arbejder. På et tidspunkt fik hun en mandlig student fra Harvard til at arbejde i laboratoriet. Når teknikeren så skulle lave noget til den opstilling, Lene Hau har bygget, og som hun kender hver eneste knap på, så snakker teknikeren kun til studenten. Sandsynligvis fordi studenten er en mand, og fordi teknikeren har svært ved at tage imod ordrer fra en kvinde.

»En kvinde skal jo helst være sød og smile lidt. Tærsklen for, hvornår en kvinde bliver anset for at være for skrap, er meget, meget lav,« siger Lene Hau, og griner selv lidt af det.

Under Lene Haus videnskabelige opvækst i Århus var der til gengæld aldrig problemer af den slags.

»I Århus har jeg altid følt mig godt tilpas. Jeg har været der som videnskabsperson, ikke specielt som kvinde, og

jeg vil faktisk sige, at jeg aldrig havde tænkt over det som et problem.«

Men Lene Hau fortæller så alligevel om den mærkelige oplevelse af, at frafaldet blandt kvinder blev større og større, jo længere hun kom op i systemet. Ved overgangen fra specialet til ph.d. en var der et kæmpe frafald, og da hun så gik ind i en aktiv frontforskerkarriere, var der ingen andre kvinder tilbage.

»Jeg kan se samme mønster her i USA. Jeg kender en kvinde, som har en ph.d. i fysik, og hun er vældig god. Så gifter hun sig med en mandlig ph.d. i fysik, og selvom hun fagligt er bedre end han, følger hun med ham og får en stilling dér, hvor han får en stilling. Og nu flytter han igen, og så flytter hun bare med. Hvad pokker sker der, kan man spørge. Selv i min generation er det sådan; at når man får familie og børn, så er det konen, der passer på børnene og manden, der går ud og arbejder.«

Forbillede

Til trods for det, har Lene Hau aldrig været tilhænger af positiv særbehandling. Hvis man absolut vil besætte en stilling med en kvinde, så ved alle jo, at hun fik den, fordi hun er en kvinde, og ikke fordi hun er god. I stedet mener Lene Hau, at man bliver nødt til at vente på de rigtig gode kvindelige forskere, som så kan fungere som forbilleder for samfundet og for de studerende.

»I min undervisning på Harvard siger jeg til mine studerende, at man ikke kan få altting. Man må foretage nogle valg og fravalg. Og det kan være utroligt svært. Jeg har valgt at satse på min karriere, og jeg synes, det er rigtigt for mig, men det er ikke nødvendigvis rigtigt for alle.«

Kun meget få af Lene Haus kvindelige kolleger på Harvard har børn. Til gengæld har langt de fleste af de mandlige forskere børn, men så har de som oftest en kone, der enten ikke arbejder eller som har et flexjob. Børnepasningsordningerne er heller ikke så veludviklede i USA som i Danmark, og det sætter grænser for udfoldelsesmulighederne. Men alligevel er rollerne mellem mænd og kvinder klart definerede i forskerverdenen, og det kræver stor omtanke og en stærk personlighed at bryde med dem.

Forskningsglæde

Men først og fremmest kræver det en stor glæde ved

Information
29/5-00

GENNEMBRUD - I et mandsdomineret fag som fysik skal man som kvinde presse på for at få sine ting igennem, fortæller fysikeren Lene Hau. Mere end mændene. Og man skal helst også være bedre end dem for at kunne bestride den samme stilling
Foto: Maryann Nilsson/AP/Nordfoto



at arbejde med eksperimentel fysik og med matematik. Og den har Lene Hau haft fra barnsben af.

»For mig er det fascinerende at tænke på al den fantastiske kreativitet, som mennesker har puttet ind i konstruktionerne og i teknikken.«

Lene Hau har også andre fritidsinteresser end at forbedre sine eksperimenter. Hvis der kommer et hul, vil hun gerne til New York og besøge vennerne og høre noget jazz. Og når foråret kommer, håber hun på at komme ud på sin cykel.

Desværre er der ikke meget tid til den slags lige nu. Og egentlig er Lene Hau slet ikke så ked af dét. Allerede, og med stor begejstring, fortæller hun om de mange projekter, der venter forude:

»Jeg har masser af ting at gå i gang med. Jeg har for eksempel sendt en ansøgning afsted til DARPA (Defense Advan-

ced Research Program Agency), der handler om, at jeg vil lave et optisk medium på en chip, hvor vi bruger den nyeste nanoteknologi til at mikrofabrikere meget små strukturer af min opstilling til at nedkøle atomerne. Det ville være et fantastisk nyt værktøj, og så vil man kunne finde anvendelser, som bruger langt mindre strøm til at kontrollere atomerne.«

Lene Hau er også gået i gang med at ville lave små kunstige sorte huller ved hjælp af sin forsøgsopstilling i laboratoriet. Med det langsomme lys vil det ikke være farligt, for så er det kun lyset, som ikke kan undslippe.

»USA er et stort land, og et sted som Boston findes ikke bedre i denne verden. Her er en så fantastisk stor koncentration af gode videnskabsfolk, og jeg har det vældig sjovt. Alt i alt er det virkelig spændende at være her.«

Fakta

Perspektiverne er enorme

Atomere kan nedkøles så meget, at de næsten ikke bevæger sig. Lene Hau brugte laserlys og stærke magnetfelter til at nedkøle atomerne så meget, så de kun var 0,000.000.435 grader over det absolutte nulpunkt, som er -273,15°C. Ved denne temperatur danner atomerne en tilstand, som man kalder for et Bose-Einstein kondensat. Denne besynderlige tilstand, der i Lene Hau's opstilling ser ud som en mikroskopisk lille cigarformet sky, er karakteriseret ved, at alle atomer i skyen er i én og samme 'kvantetilstand'. Det vil sige, at de enkelte atomers position i skyen tværes ud og overlapper hinanden, så der dannes en slags superatom.

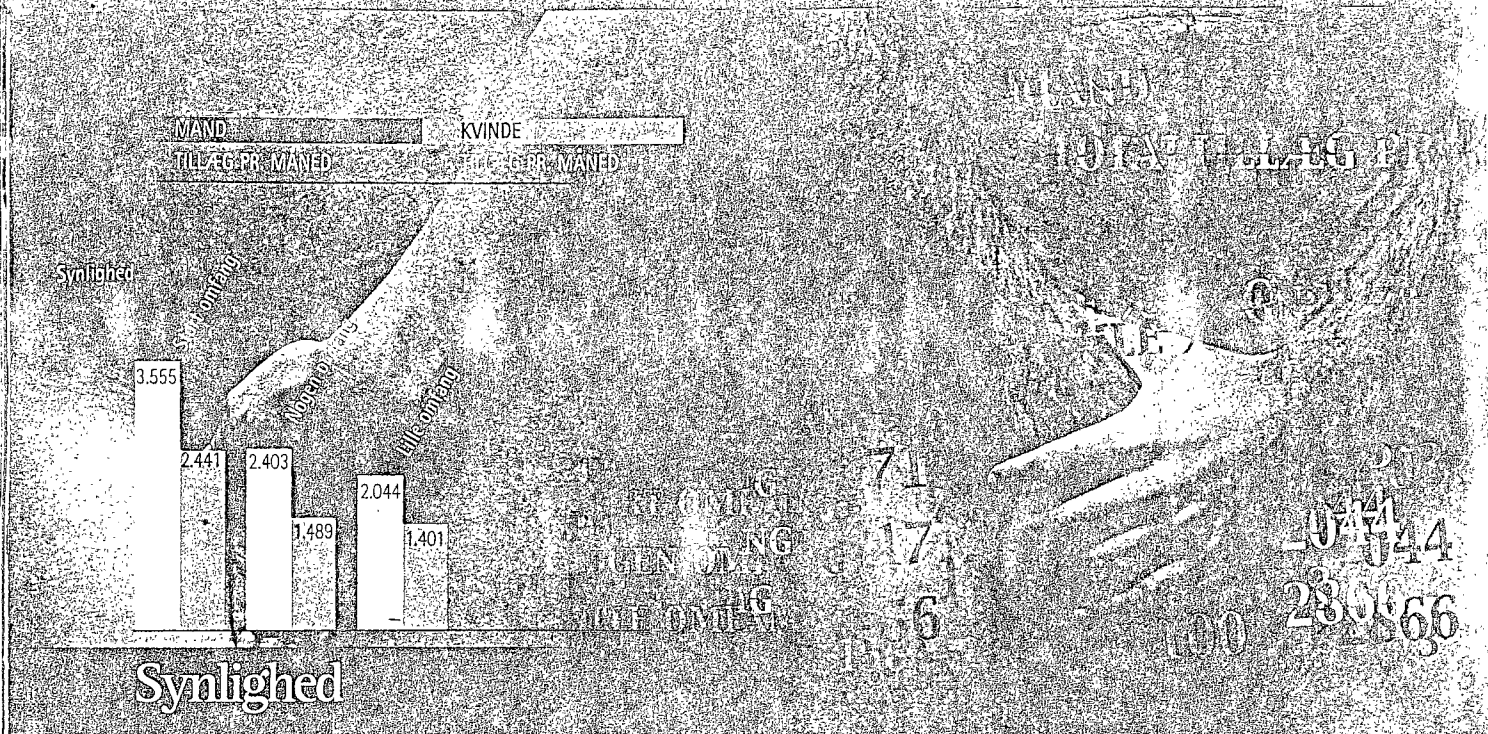
Da Lene Hau fandt på at sende lys - det vil sige fotoner - igennem skyen, viste det sig, at hun kunne holde dem fanget meget længere end tidligere antaget. Og hun forbedrer tek-

nikken ustandseligt: »Vi er i øjeblikket nede på 50 cm i sekundet, så det er en faktor 34 længere nede end sidste år,« siger Lene Hau.

Perspektiverne er, at man vil kunne manipulere lyset til at få forskellige egenskaber. »Vores mål er at reducere lysets hastighed ned til én centimeter i sekundet, så vi er faktisk nået halvvejs,« siger Lene Hau.

Hvis der melder sig private investorer, vil der være store perspektiver i at lave et Bose-Einstein kondensat på en enkel chip, mener Lene Hau:

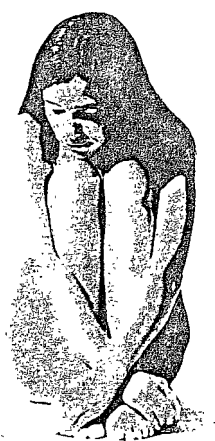
»Og når man først er kommet så langt, kan man begynde at tænke i anvendelser. Man kunne lave optiske kontakter; man kunne opkonvertere lysets frekvens, for eksempel fra infrarød til synligt lys - og alt det på enkelt foton-niveau. Man kunne lave dynamisk kontrollerbare optiske delay lines. Det ville være en fantastisk milesten.«



Den ulige fordeling af tillæg går igen på kryds og tværs i undersøgelsen af miljømagistres løn i amterne. Her er de delt op i tre grupper alt efter om de oplever deres arbejdsopgaver som synlige for ledelsen.

Flittige og fattige

Hun er blevet kaldt "dumsmart" og "uvidende" og "helt ude af trit med virkeligheden". Erhvervspsykolog Marianne Krøyer har bragt sine i kog på en række gå hjem-møder for kvindelige magistre. Hun påstår at kvinderne selv er med til at holde deres løn nede.



"Jeg synes at den faglige kunnen ofte forbigås når der tales om kursusudbud og løntillæg. Ofte tilgodeses ledelsesfunktioner såvel lønmæssigt som via en overflod af kurser."

"Hvis du ikke selv sætter pris på dit arbejde, hvorfor skulle andre så gøre det?"

Sådan har det retoriske modspørgsmål lydt fra Marianne Krøyer når hun på efterårets gå hjem-møder er blevet mødt med magistrekvindens modstand mod "at sælge sig selv" og "prale" og overtage mændenes adfærd på arbejdspladsen.

Trods modstanden står hun fast: Kvinder skal lære at gøre sig synlige. De skal gå efter de prestigefyldte opgaver og tage del i ledelse og udvikling. De skal droppe den interne mis-

undelse og trække hinanden op i stedet for ned. Og så skal de lære at bringe børnene i stedet for altid at hente dem. Ellers vil de tabe stort til mændene i det nye lønsystem.

"Kvinder arbejder generelt mere effektivt end mændene. Flere undersøgelser har vist at mænd bruger en betragtelig del af arbejdstiden på at snakke. De laver networking og skaber kontakter på kryds og tværs i organisationen. De er bedre orienteret og langt mere synlige. Især sidst på eftermiddagen hvor alle de spændende møder ligger, og hvor cheferne cirkulerer rundt på arbejdspladsen," siger Marianne Krøyer, der i tretten år har arbejdet som selvstændig erhvervspsykolog med ledelsesudvikling som speciale. Hun er blandt andet sparingspartner for ledere af begynderkon i både offentlige og private virksomheder.

Synlighed giver bonus
Marianne Krøyer anerkender at der i dag er sociale og kul-

turelle barrierer for en lige løn. Hun anerkender at kvinder ofte skal kæmpe hårdere for at få det samme i posen. Men hun påstår at kvinder selv er med til at skabe uligheden. De udviser lønhæmmende adfærd.

I løbet af sidste efterår har hun mødt et par hundrede magistrekvinder på gå hjem-møder med titlen "Når kvinder forhandler løn."

Mange har nikket genkendende til hendes pointer, mens nogle har følt sig provokeret og kaldt dem letkøbte og dumsmarte. Kommentarer som "Man kan høre at du kommer fra det private" eller "Du kender ikke vilkårene i Nordjylland" har mødt Marianne Krøyer når hun har fremhævet kvinders manglende evne – og vilje – til at hente en ordentlig hyre hjem.

"Pengene er små i det offentlige, men de er dog stadig lidt større for mænd end for kvinder, og når det gælder mekanismerne i løndannelsen og de to køns adfærd er forskel-

Sådan er det gjort

Dansk Magisterforenings "Undersøgelse af løn- og arbejdsforhold for Dansk Magisterforenings medlemmer i amtskommunernes miljø- og teknikområder" er foretaget af Uni•C. Den hviler på spørgeskemaer som er besvaret af 250 magistre ud af 368 mulige i 14 amter.

Der er flest cand.scient.'er og flest mænd i undersøgelsen, to ud af tre, men det har man selvfølgelig taget højde for i alle sammenligninger mellem de to køn, ligesom tillæg til medarbejdere på deltid

er ganget op så de svarer til fuld tid. Desuden er der foretaget en såkaldt bortfaldsanalyse for at være sikker på at de magistre der har valgt at svare, ligner det gennemsnit man kender fra foreningens medlemsregister.

Alle tillæg der automatisk følger med en bestemt stilling som for eksempel rådighedstillæg og turnustillæg, er sorteret fra i undersøgelsen.

Tilbage er de individuelle tillæg, der i det gamle lønsystem kan være udløst fra decentrale puljer, lokalløn eller

som paragraftillæg, mens elastikkerne i det nye lønsystem hedder funktionstillæg, kvalifikationstillæg eller resultatløn.

Undersøgelsen viser derfor ikke hvad amternes miljømagistre i alt får i løn eller tillæg, men kun hvordan de individuelle tillæg bliver fordelt. Dem man selv skal kæmpe for.

Mændene tager i øvrigt oftere selv initiativ til en lønhøjelse gennem individuelle tillæg end kvinderne. Blandt den tredjedel af magistrerne der overhovedet har den slags

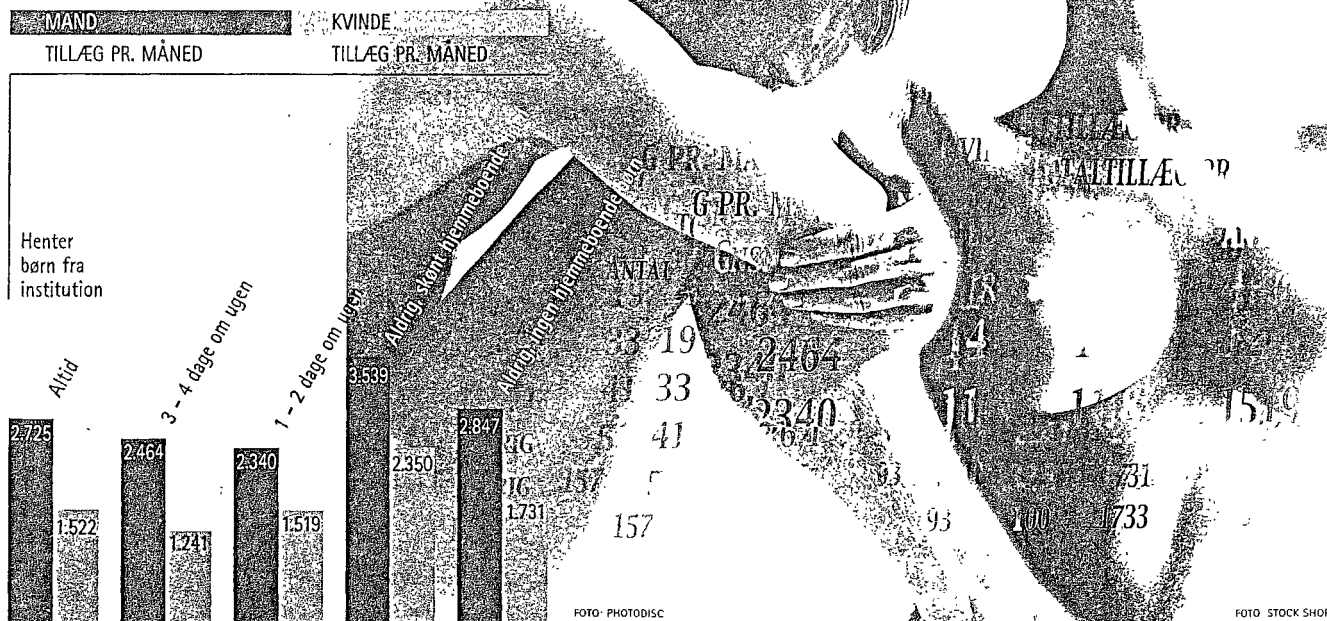
tillæg, tog 41 pct. af mændene selv initiativet til lønforhandlingen mod 29 pct. hos kvinderne. I de øvrige tilfælde var det arbejdsgiveren, tillidsrepræsentanten eller et fælles initiativ fra flere.

Flere deltagere i undersøgelsen har kommenteret deres svar i spørgeskemaet. Citaterne på temasideerne er plukket fra deres kommentarer.

Hele undersøgelsen kan læses på nettet hos www.magister.dk. Klik på DM og klik under "Nyheder".

Børn er ingen hindring

Hver femte kvinde oplyser at hun altid henter børnene fra institution mod hver tiende mand. Selv de mænd der altid henter børn har dog højere tillæg end de kvinder der aldrig henter børn.



len mellem private og offentlige arbejdspladser ikke stor. Modstanden kommer af at jeg viser dem hvad de kan gøre for at få mere i løn og smider en del af ansvaret tilbage til dem selv. Ansvar er besværligt og angstprovokerende. Det er langt mere trygt og bekvemt at brokke sig blandt ligesindede."

Krumtappen i højere løn er

synlighed, påstår hun.

"Mange kvinder har på møderne stolt forklaret at de deler opgaven med at bringe og hente børn med deres mand. Men systemet er oftest at han bringer og hun henter. Det trykker hendes løn og fremmer hans. Hun møder tidligt på arbejde og er myreflittig, men det giver ikke bonus for der er ikke

en kæft der ser det. Han kan til gengæld deltage i de prestigefyldte opgaver og alle de spændende møder der typisk ligger fra midt til sidst på eftermiddagen. Han kan også tage nogle af de ledelsesfunktioner der kræver elastik i arbejdstiden. Og når cheferne cirkulerer i organisationen - og det foregår altså ikke om morgenen,

men sidst på dagen - er han synlig, mens hun er væk."

Løn som forskyldt

Synlighed får man dog især gennem prestigefyldte opgaver. De er ifølge Krøyer: Ledelse, udvikling og analyse.

"Man kan diskutere om det er retfærdigt, men virkeligheden er sådan: En udviklings-

FOTO: PETER OLSEN



Erhvervspsykolog Marianne Krøyer: "Jeg tror ikke på ligeløn før kvinderne lærer at markere sig på fordelingen af arbejdsopgaver, og før de bliver bedre til at huske deres chefer på den fortræffelige indsats de har ydet."



opgave takseres på alle arbejdspladser som mere værdifuld end det daglige slid for at holde butikken kørende. Chefen ser det første og i mindre grad det sidste, og tillidsrepræsentanterne er tilsyneladende enige med ledelsen i vurderingen af hvad der bør udløse tillæg og lønforhøjelse."

Med mindre kvinderne kan indføre helt nye værdinormer i virksomheden, må de tage del i ledelse og udvikling hvis de vil have mere i løn.

"Kvinder er tilbøjelige til at vælge opgaver efter lyst eller til at tage det der er tilbage når de tunge sager er fordelt. Jeg tror ikke på ligeløn før kvinderne lærer at markere sig på fordelingen af arbejdsopgaver, og før de bliver bedre til at huske deres chefer på den fortræffelige indsats de har ydet," siger erhvervspsykologen og fremhæver for kvinderne hvad mange mænd har vidst meget længe: Lønforhandlinger foregår hele året.

"Mænd går ind til deres chef når de har løst en stor opgave og positionerer sig til en senere lønforhøjelse. De markerer sig og profilerer sig, og de hjælper og støtter hinanden i det kollegiale netværk som de har taget sig tid til at etablere, mens kvinderne sad bag skærmen og knoklede sagsbunker ned."

■ Kvinde er kvinde værst

På møderne med kvindelige magistre har især én påstand provokeret sindene. Påstanden om kvinders bevidste eller

ubevidste ønske om at holde hinanden nede.

"En af grundene til at kvinder ikke markerer sig og profilerer i samme grad som mændene er frygten for de andre kvinders reaktion. Og frygten er desværre velbegrundet. Mænd siger: "Hvis han kan, kan jeg også." Kvinder siger: "Hvis jeg ikke må, så må hun heller ikke," fremhæver Marianne Krøyer og understreger at der selvfølgelig kun er tale om en tendens og at udsagnet ikke er møntet på den enkelte mand eller kvinde.

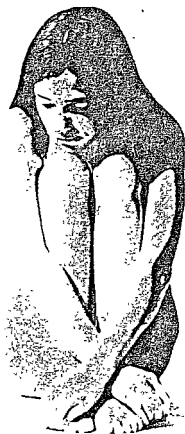
"Mænd støtter hinanden samtidig med at de konkurrerer og gør på den måde hinanden meget synlige. De refererer til hinandens udsagn på møder, anbefaler hinanden til arbejdsgrupper og fremhæver hinandens rapporter – og sparker måske også lige en fodnote ind om deres eget projekt," siger hun og fremhæver at kvinder har enorm meget misundelse kørende under den pæne overflade.

Ingen må få mere. Ingen må skille sig ud.

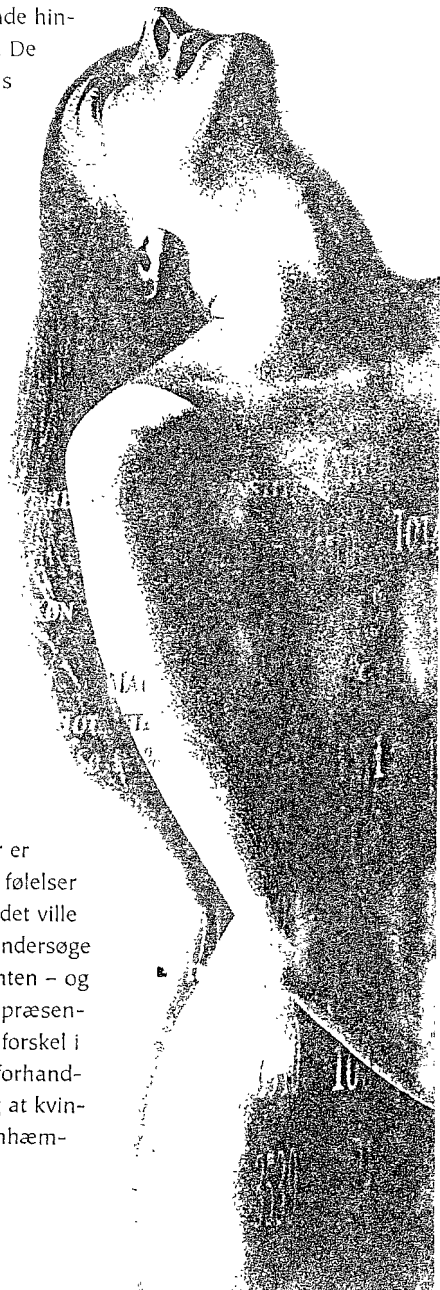
"Det er ikke tilfældigt at især kvinder har ønsket de decentrale lønpuljer udløst som gruppetillæg. Kvinder er tilbøjelige til at koble følelser på løndannelsen, og det ville være interessant at undersøge om tillidsrepræsentanten – og måske endda tillidsrepræsentantens køn – gør en forskel i det spil. I direkte lønforhandlinger er min erfaring at kvinders følelser er en lønhæm-

mer. Det gælder både positive og negative følelser," siger Marianne Krøyer og henviser til en svensk sociologisk undersøgelse der viser at kvinder knytter sig for meget til chefer og kolleger, og at de tætte relationer er en barriere for at stille krav.

"Kvinder kan i fuldt alvor mene at de bør skrue lønkravet ned fordi det er synd for chefen at han eller hun er i klemme med sit budget. Men hvorfor skal det være kvinders lønandel der betaler hver gang?"



"Den måde lønforhandlingerne foregår på med tillæg eller ej er meget ugennemskuelig – jeg tror at vi er mange der er blevet tabt på den konto."



Positiv særbehandling

Universitetet må gerne vælge en kvinde til en stilling, selv om hun ikke er helt så kvalificeret som en mandlig ansøger, siger EU-domstolen i en vejledende afgørelse. Men det er i strid med EU-retten at udpege en kvinde, hvis hun ikke er "tilnærmelsesvis jævnbyrdig"

Procedurer til positiv særbehandling af kvinder må ikke praktiseres sådan, at mænd med noget bedre kvalifikationer bliver vraget. Der må heller ikke laves opslag eller programmer, som har som sit (hoved-)formål at fremme kvinders (eller mænds) ansættelse i en stilling.

Det siger EU-domstolen i en vejledende afgørelse (i sag C-407/98 med dom af 6. juli 2000).

Dommen er imidlertid ikke entydig, for domstolen siger samtidig principielt, at det er tilladt at foretrække en kvinde, når kvinder og mænd er "jævnbyrdige eller tilnærmelsesvis jævnbyrdige", forudsat "at ansøgningerne vurderes objektivt under hensyntagen til alle ansøgernes særlige, personlige forhold". I praksis betyder formuleringen "tilnærmelsesvis jævnbyrdige" en åbning af den hidtidige praksis, som er gået ud fra jævnbyrdighed. I den forstand er dommen en blåstempling af den svenske praksis, hvilket er modsætningsfyldt idet svenskerne underkendes i den konkrete sag!

Konkret sag

Gøteborgs Universitet overtrådte EU-retten, da man i 1997 udpegede Elisabet Fogelqvist til et professorat i Hydrosfæreviden-skab frem for Leif Anderson på trods af at hans kvalifikationer var (dokumenter-bart) bedre end hendes.

Retten lægger i sin dom vægt på, at vel var det legalt at ansætte kvinder efter en bedømmelse, hvor det for eksempel ikke kommer kvinden til skade, at karrieren har været afbrudt af deltidsarbejde, (børne-) orlov eller lignende. Hensigten hermed er at forebygge de kønsmæssige ulemper, der kan være for kvinder.

EU-retten konstaterer imidlertid, at disse ligestillings-initiativer ikke betyder, at der måtte laves en positiv udvælgelsesmetode, der giver kvinder fortrinstillig, "hvis den positive udvælgelse ikke står i rimeligt forhold til formålet".

I den konkrete dom hedder det så, at den professor-kvalificerede kvinde ikke måtte foretrækkes frem for en mand, der er bedre kvalificeret. Som en underliggende præmis for dommen synes det at indgå, at der i Gøteborg var så stor forskel mellem ansøgernes kvalifikationer, at det ville være i strid med "objektivitet ved udnævnelsen" at udpege manden.

"Som jeg læser afgørelsen, underkendes Gøteborgs Universitets udpegning af en kvinde, fordi der var for stor forskel på kvalifikationer mellem hende og en mandlig konkurrent. Dommen siger, at



man ikke må tage en kvinde, der er kvalificeret lige over bundgrænsen, på bekostning af en mand, der er meget kvalificeret," siger HH-professor Ruth Nielsen, der som ekspert i erhvervsret også kender EU-lovgivningen.

Næse til svensk særlov

Sagen opstod som følge af den svenske høgskeleforordning, hvoraf det fremgår, at der kan ske positiv særbehandling ved besættelse af en bestemt type stillinger som led i et ligestillingsinitiativ. Og helt særligt i den svenske ordning indgår så,

at der vil kunne vælges en kvinde, hvis hun blot bedømmes "kvalificeret" - og på trods af, at der er en mand, som objektivt set er bedre kvalificeret. Der må blot ikke være så stor forskel mellem deres kvalifikationer, at anvendelsen af positiv særbehandling kommer "i strid med kravet om objektivitet ved besættelsen af stillingen".

Hensigten med den positive særbehandling på høgskele-området var som en engangsforestilling at lave positiv særbehandling på 30 professorstillinger.

Men EU-domstolen underkender i den aktuelle sag udnævnelsen af Elisabet Fogelqvist, fordi udpegningen er sket på bekostning af en mand, som er dokumenteret bedre kvalificeret, og fordi opslaget for ensidigt er rettet mod kvinder.

Objektiv bedømmelse?

Den faglige bedømmelse af ansøgerne viste nemlig, at alle vurderede Leif Anderson som den fagligt, videnskabeligt mest kvalificerede.

Det var tilmed sådan, at Anderson af indstillingsudvalget var den mest kvalificerede, en anden kvindelig ansøger (som senere trak sig) var den næstbedst kvalificerede og Fogelqvist landede på tredjepladsen.

Da nummer to ansøgeren havde trukket sig, blev bedømmelsesudvalget bedt om en ny indstilling, hvilket man nægtede, idet man stod fast på den foretagne vurdering, og idet man fandt forskellen mellem Anderson og Fogelqvist "betydelig". Hermed sagde udvalget så indirekte, at man ved at konstruere en argumentation for Fogelqvist ville komme i strid med kravet om objektivitet ved udnævnelsen.

På trods af bedømmelsesudvalget indstilling valgte Gøteborgs rektor så alligevel at tildele Fogelqvist professoratet, idet han anførte, at forskellen mellem ansøgernes kvalifikationer ikke var så stor, at positiv særbehandling ville være i strid med kravet om objektivitet.

Anderson klagede derfor til Overklagenævnet, som konstaterede, at kravet om objektivitet ikke må indebære, at der sker positiv særbehandling, såfremt det indebærer "en klar risiko for effektivitetstab inden for de nævnte områder, hvis den mest kvalificerede ansøger ikke blev udvalgt". Men Overklagenævnets afgørelse kolliderede ikke med Gøteborg-rektorens afgørelse, idet nævnet ikke vurderer, at forskellen mellem ansøgernes kvalifikationer ikke var særlig stor.

Men Overklagenævnet valgte efterføl-

gende at prøve den svenske lovgivning mod EU-retten. Og her blev man altså underkendt i den konkrete sag.

Det er nu op til de svenske instanser at tage konsekvensen af EU-domstolens vejledning. (Domstolen afgør ikke konkrete sager, men overlader dette til de nationale instanser.)

FREJA: Lige kvalifikationer

EU-dommen stiller spørgsmål ved den danske praksis:

Det danske FREJA-program, som bl.a. havde til formål at udnytte kvaliteterne i den yngre forskergeneration samt at "fremme kvindelige forskeres synlighed i forskningsverdenen", uddelte 78 millioner kroner i 1998.

Forskningsrådene fik dispensation fra ligebehandlingsloven, så programmet kunne baseres på positiv særbehandling. Det betød, at ved bedømmelse af ansøgninger inden for fagområder med kvindeunderskud, ville ansøgerne fra kvinder blive foretrukket, "når der ud fra en konkret vurdering af projekter og ansøgere var tale om lige kvalifikationer". Med denne formulering har man formentlig undgået at komme i den svenske klemme.

Programkomiteen valgte ved bedømmelse af ansøgningerne - ud over den faglige vurdering - at lægge vægt på ønsket om at øge kvinders synlighed inden for et forskningsfelt og/eller, at en bevilling kunne være af væsentlig betydning for en perspektivrig fastholdelse eller videreuddannelse af lovende kvindelige forskere.

Der indkom 327 ansøgninger, men de 22 mandlige ansøgere blev forbigået. 16 kvinder fik bevillinger i størrelsesordenen 2.5 - 8 millioner kroner.

Ansættelsesbekendtgørelse i strid med EU-regler?

EU-dommen kunne rejse tvivl om universiteternes nye ansættelsesbekendtgørelse. Ifølge den gamle procedure skulle bedømmelsesudvalget prioritere og rangordne ansøgerne. Nu er der kun krav om, at udvalget - uprioriteret - skal vurdere om ansøgerne er kvalificerede. Det skal ikke vurderes, hvem der er

mest kvalificeret, fx om der er en mand, som er meget mere kvalificeret end en kvinde.

Denne passus i loven blev indført med Forskningsministeriets udtrykkelige intention om hermed at fremme muligheden for at udnævne kvinder frem for mænd.

Professoren Ruth Nielsen har tidligere arbejdet med kvindere. Hun vil ikke sige, at ansættelsesbekendtgørelsen - som ikke udtrykkeligt skal pege på den mest kvalificerede og dermed kan begunstige kvindelige ansøgere - er i strid med EU-rettens afgørelse:

"Med Amsterdamtraktatens § 141, er der generelt sket en udvidelse af rammerne for en aktiv ligestillingspolitik, så der er flere muligheder. Man skal jo tænke på, at der typisk vil være flere kriterier i et stillingsopslag, og at dem med udnævnelseskompetencen skal tage hensyn hertil ved prioriteringen," siger hun.

EU-reglerne er forpligtende, men det enkelte medlemsland kan selv vælge at gøre brug af dette "vejledende" spillerum i den nationale lovgivning og administration.

Hvad er "tilnærmelsesvis jævnbyrdig"?

Ruth Nielsen ser ikke frem til flere klagesager ved ansættelser, når spillerummet for skøn er udvidet med formuleringen om, at kvinder kan vælges, når de blot er "tilnærmelsesvis jævnbyrdige":

"Rammen for skønnet er udvidet. Men historien viser, at alle ansættelsessager kan give fortolkningstvivl, og mange klagesager er gået på, om bedømmelsesudvalget har taget alle aspekter med i bedømmelsen. Men grundlæggende skal de, der har udnævnelseskompetencen, selvfølgelig overholde reglerne. Ledelsen skal foretage en prioritering, og hvis der er en mand, der er topkvalificeret, så må ledelsen jo læse det i bedømmelsen og udpege ham - frem for at vælge en kvinde, der bare med nød og næppe bedømmes som kvalificeret..."



For os andre er stjernestøv noget der optræder i kærlighedssange og digte. For Anja C. Andersen er det simpelt hen nøglen til at forstå hvordan det hele begyndte. Men Danmarks førende ekspert i det magiske pulver kan da godt få et regulært sug i maven når hun ser op mod en stjerneklar himmel

Frøken Stjernestøv

■ Astrofysiker Anja C. Andersen har prøvet at stå med stjernestøv i hænderne. Og det gør indtryk på selv en professionel astronom.

- Det kan bedst beskrives som spændende. Man starter med en meteoritsten der er omkring 10 gram, dvs. som en halv mandarin, og så har man omkring 0.001 gram stjernestøv tilbage når man er færdig med at ætse fire måneder senere, siger Anja C. Andersen.

At det kan lade sig gøre skyldes at bittesmå korn af det ellers så sværmeriske støv har lejet sig i meteoritter - de sten der er faldet ned på jorden fra rummet. Når man pulveriserer meteoritterne, kan man udvinde stjernestøvet, og det

er hvad Anja C. Andersen har gjort i laboratorier ved Københavns Universitets Astronomiske Observatorium. I årevis har hun forsket i stjernestøv fordi det indeholder rige spor at gå efter hvis man ønsker at forstå hvordan vores solsystem og livet på jorden opstod. Dette store mysterium har Anja C. Andersen været optaget af lige siden teenage-årene. I dag er hun 34 år og Danmarks førende ekspert i stjernestøv som er en af universets vigtigste bestanddele.

- Det har længe været almindelig basisviden for astrofysikere at det var stjerne-erne der dannede de grundstoffer der blev byggestenene i vores solsystems planeter. Vi ved til gengæld ikke hvilke stjerner der leverede hvilke grundstoffer. Det kan stjernernes støv hjælpe os med at fortælle, siger Anja C. Andersen. Stjernestøv findes på meteoritter, men det svæver også frit i rummet. Når en stjerne brænder ud efter at have skinnit og strålet i mange millioner, måske milliarder af år, foretager den en slags sidste krampetrækninger hvor den udånder kæmpemæssige skyer af stjernestøv. Det varer fra 100 til 1000 dage, og i den periode gælder det for en stjernestøvseksperter om at have booket sig ind på en af verdens bedste og største teleskoper og at have sikret sig adgang til satellitbilleder af fænomenet. At se støvet komme ud af stjernen er både fagligt og æstetisk en oplevelse af det helt store.

- Støvet kommer fra stjernen og ud i rummet hvor det sammen med gas laver nogle af de smukkeste formationer man kan tænke sig.

RØDE KÆMPER

Samtidig giver det Anja C. Andersen mulighed for at undersøge om stoffet fra meteoritterne også optræder i stjernestøvsskyerne. Hvis det synes at være tilfældet, og hvis hun kan sandsynliggøre at støvet bliver genbrugt i universets kredsløb, så vil hun være kommet et stort skridt nærmere forklaringen på hvordan solsystemet og jorden opstod.

- Det vil være interessant at vide fordi vi gerne vil forstå hvordan jorden blev dannet. For at forstå jordens oprindelse må vi forstå solsystemets oprindelse, og for at forstå solsystemets oprindelse må

vi forstå hvordan stjerner og planeter bliver dannet. Denne forståelse kan vi nå frem til ved at studere de store gas- og støvskyer som stjernerne og planeterne bliver dannet af. Gas- og støvskyene er nemlig dannet af materiale fra gamle, uddøde stjerner. Det vil sige at de stjerner der har lavet det støv som jeg studerer ikke eksisterer mere. De er brændt ud.

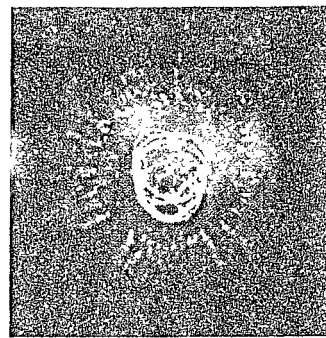
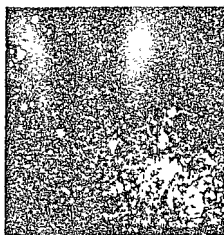
Anja C. Andersen har især interesseret sig for kulstoffer som mennesker består af og for kulstof-stjerner – med det poetiske navn kæmpe røde stjerner - ud fra den antagelse at de har været hovedbidragyderne til jordens kulstof. Indtil videre er hun ikke stødt på noget der går imod denne antagelse, men der er stadig lang vej endnu før hun kan føle sig sikker. Hun er nødt til at foretage endnu mange undersøgelser hvor hun skal tage højde for forskellige forhold. - Sådan er det i fysikken. Den er meget kompleks. Man kan ikke bevise at en teori er rigtig, men man kan vise at en teori er god ved at vise at den ikke er forkert. Man udtænker en teori og bruger dernæst resten af sit liv på at prøve at gennemhulle den. Hvilket man selvfølgelig ikke håber lykkes. Det er netop på grund af den lange proces at Nobelprismodtagere ofte er ældre forskere. De får prisen for en idé de lancerede allerede i deres ungdom og som efter et langt livs eksperimenter har vist sig at holde vand.

DET SKJULTE INDRE

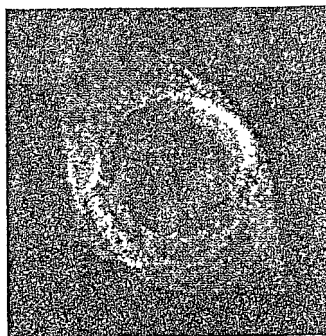
Foruden observationerne og laboratorieanalyserne arbejder Anja C. Andersen også med computermodeller af stjerner som bliver modelleret efter hvordan hun tror forskellige fysiske fænomener fungerer.

- For eksempel kan man ikke se hvordan en stjerne ser ud indeni. Derfor laver man en model af en stjernes indre og beregner hvordan den pågældende stjerne vil se ud på overfladen. Derefter

*Til højre: Resterne af en døende stjerne.
Kilde: NASA.*



*Ovenfor: Formation af nydannede stjerner.
Til højre: Et virvar af galakser to milliarder lysår fra jorden.
Kilde: NASA*



For tusinder af år siden kastede den døende stjerne, som ses i den blå tåge i midten, denne formation af gas og støv fra sig. Kilde: Hubble Heritage Team.

kan jeg observere forskellige stjerner og se om de rent faktisk også ser ud som i teorien. Det vil sige at jeg laver modeller af hvordan jeg forventer en stjerne vil se ud i den fase hvor den laver bestemte typer af støv. Når min computermodel er klar, sammenligner jeg den med observationer for at se om det er en god model, dvs. en god teori jeg har for den pågældende type stjerne.

Anja C. Andersen er glad for den vekselvirkning der ligger i hendes forskningsarbejde: Laboratoriet, observationerne og computermodellerne.

- Det giver afveksling, og jeg bliver lige opslugt i alle faserne. I laboratoriet går der lidt Georg Gearløs i mig. De instru-

menter jeg skal bruge er sjældent designet lige til det formål jeg har tiltænkt dem. Så er det i gang med elastikker og andet forefaldende materiale som jeg kan bruge til at optimere udstyret. På den anden side er det også spændende at sidde ved computeren og efterprøve forskellige teorier. Og hvad observationerne angår - dem kan man ikke undvære, for det er dem som computermodellerne skal sammenlignes med.

SKOLEPIGENS DRØM

Inspirationen til at blive astronom fik Anja C. Andersen allerede i 6.-7. klasse. - Jeg havde en fysiklærer der var meget begejstret for solsystemet, og det

Frøken Stjernestøv



smittede af på mig. En aften tog han klassen med op i Rundetårn-observatoriet for at kigge på månen og stjernerne, og så var jeg solgt.

Så snart hun kom hjem fortalte hun sine forældre at hun ville være astronom. De syntes det lød spændende og sørgede for at hun ikke løb tør for inputs. Til jul og fødselsdage gav de hende bøger om astronomi, og de forærede hende også en lille kikkert.

- Min far tog på ture med mig til observatorier, og min mor var tvangsindlagt til at lytte til mine beskrivelser i timevis. Det store ukendte univers var dragende mystisk. Jeg undrede mig over at planeterne i vores solsystem kunne være så

forskellige. Hvorfor har Saturn en ring og hvorfor har Jupiter en rød plet? Den undren har jeg stadig, og der har aldrig været andre emner der har kunnet overskygge min begejstring for astronomien.

SUG I MAVEN

Selv om Anja C. Andersen har forsket i astronomi i mange år, er hun stadig lige fascineret af det der oprindeligt fik hende i gang: Himlen.

- Jeg får stadig sug i maven når jeg for eksempel kigger på månen gennem en kikkert. Det er så fantastisk at man kan se dens kratere og bjerge. I det hele taget er det fascinerende at studere himmelhvælvet, og jeg går af og til ud

om aftenen og kigger, selv om der er meget lysforurening i Københavnsområdet.

Til efteråret pakker Anja C. Andersen familien - mand, tvillingepiger der nu er syvethalvt og en dreng på et halvt år - sammen og rykker til Sverige. Takket været et forskningslegat fra Carlsbergfondet har hun fået mulighed for at samarbejde med et hold forskere ved Uppsala Astronomiske Observatorium.

- De har udviklet nogle meget raffinerede computermodeller af stjerner, og det vil få afgørende betydning for min forskning at få afprøvet mine data og teorier på dem. Planen er at vi siden skal sammenligne vores computerresultater med virkelige observationer. Jeg glæder mig meget. Uppsala-opholdet bliver afgørende for min forskning. ■

The excerpt below is from the article, "Career Perspectives of six Women Engineers", appearing in IEEE Spectrum, Vol. 36, no. 12, December 1999, pp. 69-77. [<http://www.ieee.org/about/>] The article was produced by Linda Geppert, Senior Editor of Spectrum. The excerpt is from a panel presentation by Monique Frize, a professor in the department of system and computer engineering at Carleton University in Ottawa, and a professor in the school of information technology and engineering at the University of Ottawa.

According to the article, "This panel observed that women enter engineering out of a love of science and problem-solving, but often leave prematurely because of inflexible work options and slim promotion opportunities."

MONIQUE FRIZE:

I would like to talk about a study by anthropologist Ann Van Beers of 20 men and 20 women engineers in the Vancouver area.

Ann Van Beers found that women and men leave engineering for different reasons. One reason women leave is that the work environment is too rigid and there is a lack of flexible options in some companies. But even when companies offer flexible work options, women are often afraid to take advantage of them because they would appear to be less committed to their careers. Harassment, discrimination, isolation, and not feeling part of the decision process are also factors.

Then there is the existence of the old boys' network. I myself put a lot of dents into this network by forcing a more open, transparent system. When things were done behind closed doors, I would say, "Excuse me, when did that happen? I wasn't at that meeting. Or was I asleep?" That is a way to force information out; and then they have to admit, "Yeah, we had dinner together last night." And I say, "Okay, let's put this on the table for the next meeting." So there's a lot you can do to undo the behind-the-scenes proach. But it is still very much alive. So we have to continue to work for transparency and openness.

The reasons men leave engineering are quite different. The low status of the profession is a major element. Only France has a wonderful status for engineers. Lack of reasonable compensation and poor stability during the restructuring era are other factors.

Another study said that 50 percent of engineers leave the profession within 10 years-that's quite a substantial number. But that's okay. Engineers then become technologically literate citizens and contribute in various ways. The important thing is that men leave because it is a good career move.

Also interesting are the reasons women stay in engineering. Van Beers said that women stay because they like problem-solving. You heard it all morning-we totally love it. We also want to be agents of change. Being a role model is also important-it's a tall order because, as a role model, you have to be consistent and helpful to younger women and younger men. The new perspectives and skills that women bring to engineering is another reason cited.

Let me talk about why there is a need for increasing diversity in engineering. In law and medicine, it is becoming evident that women can introduce nurturing and social values to a

field that has had a white male middle class point of view for so long-not that that is bad, but it needs to be enriched with perspectives of gender and different cultures.

Ann Van Beers found that the men engineers complained that they had to do 60 percent writing in their jobs. And they said, "I didn't like writing, so I went into engineering to avoid that"-which is funny because they ended up doing it so much. But Van Beers found the women liked the writing and the teamwork.

Another difference is that men zoom into a solution quickly, while women try a variety of solutions and put the problem in context. Blending these styles provides a better and more complete solution. Two chief executive officers of major companies have told me personally that their best teams have men and women in them because they get the very best perspective and they finish the job well and quickly.

In Canada now, about 20 percent of engineering students are women. It's also 20 percent at the master's level and 13 percent at the Ph.D. level. Across the country, about 7 percent of engineering faculty are women. In 1991 the number was 2 percent.

What approaches help in getting more women faculty? First, you need women on the recruiting committees. Then, ask the department heads what they have done to find women faculty. Have they looked at Ph.D. students ready to graduate, or at postdocs? A spousal hiring program would help, too. That is very important.

Sometimes you also have to ask the deans and presidents for more money for recruitment and hiring in case you find a more experienced woman. There also has to be a shift in values. Teaching and mentoring abilities are not valued as much as they should be. Women often pursue nontraditional multidisciplinary specialties like biomedical engineering. These are considered soft and sometimes looked down upon.

Parental leave is very important. Canada has policies now. But the best countries are Sweden, Norway, and Finland, which offer a year-and-a-half of leave without loss of position or seniority. In Canada we offer 16 weeks with paid leave, and then, after that, you can ask for more leave of absence without pay. So you can take more time. But there are still many organizations without such policies.

I will leave you with one last thought because to me it is going to be a revolution: redefine success. It's okay to get a Nobel Prize. It's okay to get a CEO position. But there are many other ways to measure success. I would not feel unsuccessful if I just had better balance in my life and I enjoyed what I do. So I'm telling young women, "Just find success in your own terms. Don't go by the model that's been out there forever. Just follow your own model for success and you will be a happy engineer."

Klip fra AAS Committe on the Status of Women, 12. juli 2000.

P.S. Den "rumor mill page" der tales om i indlægget er en statistik der viser at loven om "blød" særbehandling har haft en fantastisk virkning idet kvinder altid får tilbudt stillinger, udvalgs- og bestyrelsesposter.

Jobs for Women

Dear Editor,

Thank you to Alycia Weinberger for her contribution in the 5 June AASWomen.

I was wondering, how many of the offers to women for various jobs were made to the same woman?

My impression is that in any given search, there are one or two women that everyone wants and these women get many offers. Thus, many offers to women are declined. The next offer is usually made to a man. This alone could skew the job offers number to seem like a higher number of women than actually do, have opportunities.

Unfortunately, a lot of departments who have hired a woman in a particular search, won't offer the next job to a woman because they figure they've done their "duty" to hire a woman. They will often include one or more women on their "short lists" as tokens. This is an easy thing for them to do and helps keep them in compliance with the law. (Note that it is possible for a department to never actually hire a woman and still win a discrimination lawsuit.) Departments will say they want to hire a woman, but mean it only if she's a superstar woman. Their standards for men are lower.

I can't say much for the reliability of the rumor mill page. I am confident of my impressions though, as they are formed by years of conversations with department chairs, observatory directors, other search committee members and job candidates. I have personally witnessed sexual harassment, flagrantly sexist job searches, as well as retaliation against those who have challenged these procedures. Most in the astronomical world are sophisticated enough to hide the attitudes that I have seen overtly expressed. That behavior is on the tail of the bell curve. Under the peak are similar attitudes expressed subtly.

To be sure, opportunities for women are improving. But, while the numbers on the Rumor Mill page may look encouraging, pervasive bias does not dissipate in only a few years. Please, let's not become complacent because we see women getting jobs (or because we are so busy in our own job.) Sexism is still a drag on all our careers, whether or not it is visible to each individual.

Respectfully Submitted, Kathy Mead

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PhysicsWorld

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Women matter

What do the evolution of the universe and the relative proportions of men and women in physics have in common?

Well, imagine that men are matter and that women are antimatter. And note that equal amounts of matter and antimatter were created in the big bang, just as equal numbers of baby boys and girls are born every year. Yet for reasons that are still not understood, we now live in a universe that is dominated by matter and a world where physics is a male-dominated profession. Particle physicists believe they are close to solving the first of these asymmetries, but despite much talk and some progress, a satisfactory solution to the second inequality is still a long way off.



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Marie Curie: scientific entrepreneur

A recent report that was prepared for the European Commission by the ETAN Expert Working Group on Women and Science observed that "there is a continuous drop in the numbers of women at each level of the academic ladder and many highly trained women are lost to science. Institutions that employ scientists tend to be behind the times in addressing the life/work balance and need to modernize". The working group also concluded that "the under-representation of women threatens the goals of science in achieving excellence, as well as being wasteful and unjust". Philippe Busquin, the European Commissioner for Research, has identified the lack of women scientists in Europe as a high priority for his term in office.

Good data are difficult to find but, in general, roughly equal numbers of men and women go to university in most countries. However, a "leaky pipeline" means that the proportion of women becomes smaller as you move up through the ranks in both academia and industry. This becomes more pronounced when we look at just science and technology, and even more pronounced in physics. And within physics there are considerable variations from country to country.

In the UK, for instance, only about 20% of physics undergraduates are women - although girls outperform boys in the pre-university A-level

exam - and this figure falls to 7% for lecturing staff and less than 2% for professors (compared with an average of 9% for all subjects.) Still, this represents progress of sorts: ten years ago there were just two women professors of physics in the UK, today there are at least 12. On page 8 we ask what advice these physicists have for young women who would like to follow in their footsteps.

The story is similar in the United States where only 3% of physics professors are women. However, as we report on page 9, female physicists have recently been appointed to two of the most senior research positions in the US. Elsewhere in Europe - in particular in France, Italy, Portugal, Spain and most of Scandinavia - the number of senior women scientists is noticeably higher than in the UK and US, but there is still room for improvement.

The low numbers of women holding senior positions in physics results from a combination of two factors: the relatively low numbers of women studying physics in schools and universities, and the effects of the "leaky pipeline". Physics is seen as a male subject, so those recruiting pupils and students into school and university courses must go out of their way to make the subject attractive to young women. And there is clearly some unnecessary asymmetry at work when about 20% of those starting physics degree courses are female, but only 2%-3% of the professors teaching them in some countries are women.

Lord Rutherford is often held up as an outstanding role model for young physicists, but it is to be hoped that his famous comment to Lise Meitner on meeting her for the first time - "Oh, I thought you were a man" - belongs to an era that has long past.

Female professors: still a rare breed

Women rarely make it to the top in physics. **Sharon Ann Holgate** spoke to a few who have, and asked what can be done to encourage more women to follow in their footsteps

When people ask Susan Cooper, head of particle physics at Oxford University, what her job is, "the reaction is usually astonished silence," she says. Cooper is in fact one of only a handful of women physics professors in the UK. Women hold only about 2% of physics chairs in Britain, a stark indicator of how difficult it is to attract women, and girls, into physics.

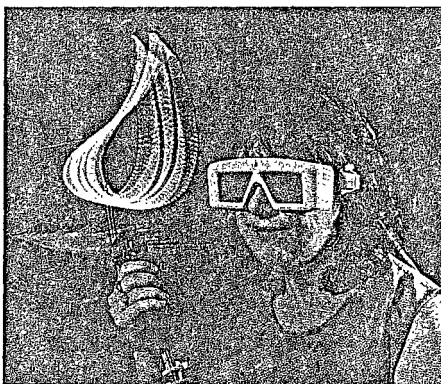
"I think peer pressure has a lot to do with it," says Athene Donald, professor in soft-condensed-matter physics at Cambridge University. "As long as boys say – whether or not they believe it – that physics and maths are not for girls, some girls will not want to contend with the hassle. Single-sex teaching may help in some cases, but is not a cure all," she says.

Ruth Lynden-Bell, professor in the atomistic simulation group at Queen's University Belfast recommends "more publicity about women scientists, and more work persuading schoolgirls to do physics" as a remedy. This sentiment was also expressed by an international panel of physicists who carried out a review of UK physics earlier this year (*Physics World* June p5).

Attracting schoolgirls into physics

The fact that only one in five physics undergraduates is female represents "a significant, unrealized potential", according to the panel's report, it also recommends that a special effort should be made to attract 12–14-year-old schoolgirls into physics. Christine Davies, head of theoretical particle physics at Glasgow University, believes that this is a good age group to target, "but I don't have any magic recipe for enthusing them about physics," she says. "Physics is a very broad subject and means different things to different people. I think you have to be careful not to imagine that everyone will be turned onto physics by 'gee-whizzery'. I was always more interested in the neat theoretical ideas."

By contrast Gillian Gehring, a professor of condensed-matter physics from Sheffield University feels that it would be better to concentrate on 15–16 year olds. "There is a real window of opportunity that we should take with the new A-level scheme," she says, referring to the fact that from this month students in England and Wales will take five AS levels in their first year of post-16 education, and three A levels in the second year. "We should try to campaign to get a higher fraction of able girls to take AS physics and maths in the first year of the sixth form," suggests Gehring.



Doing it for themselves – physics professors Sandra Chapman (top) and Ruth Lynden-Bell

Such ideas may ultimately increase the number of female undergraduates doing physics, but as the international report points out, it is equally important to retain qualified women within the physics community. Indeed, the fraction of women within physics departments decreases the higher up you go, with women only accounting for 7% of lecturers in the UK.

An international problem

The difficulty of retaining women at senior levels is not just a problem in Britain, however. A recent report from the European Commission shows that similar situations exist in many European countries. This is backed up by a report recently produced by the American Institute of Physics that says the number of women in US physics decreases "with each step up the academic ladder" (see opposite).

Norna Robertson, a professor in the gravitational waves group at Glasgow University, says she was disappointed that the international panel of physicists reviewing UK physics did not include any women. "I think that says something about the global situation," she adds.

France, however, fares better than most, with women making up 9% of physics professors. "It's definitely a cultural thing," says

Sandra Chapman, head of space and astrophysics at Warwick University, whose involvement with the Cluster space mission requires regular trips to Orleans in France. "There are lots of science magazines in France that you would not find in the UK, and you have intellectual discussions on TV where scientists are allowed to discuss developments in the same way philosophers are, rather than getting a three-minute slot on *Horizon*," she says. Chapman feels such attitudes definitely influence the numbers of women going through to attain senior positions in physics. "It's just part of being an accomplished cultured woman, which is a valued thing in France. My impression is that science there is seen in the same way as literature or history," she adds.

In contrast, one British female undergraduate who was leaving physics for media studies asked Chapman how she could feel happy working in such a male-dominated subject. "Some women who are strong feminists may say you're engaging in a male power structure. They see it as a kind of 'sleeping with the enemy' thing," Chapman explains. Some female students have also raised moral objections about the subject, including the use of physics in defence and concerns about environmental issues.

Career support

For those women who do remain in physics, there can be problems trying to balance their home life with their career. "Things would change if there were more academic jobs available in physics," says Christine Davies. "The job situation has been very bad for many years and this has made it particularly hard for women I think. They are often less able, for family reasons, to hang on in post-doc positions waiting for a job to appear."

"Long-term postdocs, such as the research councils' advanced fellowships, are particularly important in this regard," she states. Davies' advanced fellowship from the Particle Physics and Astronomy Research Council allowed her to take two periods of maternity leave, and work part time for six months after the birth of her first child. However, many women feel strongly that childcare issues should not be seen as a problem solely for them.

"I am getting fed up with this narrow focus," says Athene Donald. "It shouldn't be assumed that children are only one parent's responsibility. Children should be seen as an issue for both parents equally, with implications for both parents' employers," she says.

In the meantime, what tips for the top

would the professors give to budding female physicists? Both Davies and Chapman suggest applying for personal fellowships rather than a postdoc on someone else's project. "If you're looking to establish yourself it's a question of visibility – who goes and gives the papers at the international conferences,

and whose name goes first," explains Chapman. She feels personal fellowships have helped her succeed by giving her more control over the kind of work she was doing, and when and where she did it.

Some women suggest female mentors can help, but Susan Cooper disagrees. "I cer-

tainly never had a female mentor, and I never felt the lack of it," says Cooper, who does not feel being female has made any difference to her own career progress. At the end of the day, anyone with a strong interest in the subject would do well to take Ruth Lynden-Bell's advice, which is simply: "Do it!"

Women make slow progress in the US

Although the number of women physicists in the US is slowly rising, females are still at a disadvantage when trying to make their way in physics, reports **Peter Gwynne**

During the 1990s, the numbers of women in the US taking high-school physics, earning physics degrees and serving on physics faculties steadily increased. By the end of the decade, the fraction of women graduating with degrees in physics was more than 40% in at least 20 physics departments. And the salaries of comparable male and female physicists were almost equal.

These are the findings of a report published in June by the American Institute of Physics (AIP). These examples of the progress of women physicists in the US do not represent the entire picture, however. "Women were still sorely underrepresented in physics at the end of the century," the report says. For example, in 1998 women earned less than one-fifth of US physics degrees and only one-eighth of physics PhDs. These fractions are far lower in physics than they tend to be in other fields.

Shortly after the report was published, two women physics professors from the Massachusetts Institute of Technology (MIT) received prestigious promotions (see box). But do those elevations indicate that women physicists can break through the "glass ceiling" more easily in the US, or do they show how far women still have to go to achieve parity with men? Conversations with prominent physicists suggest a little of both.

"We have a lot of women physicists moving into positions of more power and authority," said Judith Franz, who spent several years as an academic physicist before becoming the first female executive officer of the American Physical Society. "But it is still in some cases very difficult for women. There are no female directors of national laboratories, for example."

Roman Czujko, head of AIP's Statistical Research Center, which prepared the report, says that women physicists have told him much the same. "When I talk to Millie Dresselhaus and others, they would agree that there has been progress, but it has been slow," he said. "When they walk into physics departments today, they get a different feeling than they did 20 or 15 years ago. They no longer feel that their presence is challenged. There has been progress in many departments, but there are still a lot where

MIT physicists receive high-profile promotions

While women may be moving only slowly up the ladder of American academic physics, two female physicists from the Massachusetts Institute of Technology (MIT) have recently earned significant promotions. Last month Mildred Dresselhaus was sworn in as director of the Office of Science at the Department of Energy and June Matthews was named director of the Laboratory for Nuclear Science (LNS) at MIT.

The two bring strong credentials to their new jobs. Dresselhaus, a solid-state physicist whose research has focused on graphite, fullerenes, nanotubes and other aspects of carbon, has spent 40 years at MIT, in its departments of physics, electrical engineering and computer science. Most recently she held the post of Institute Professor, a title that recognizes high academic achievement. She has served as president of both the American Physical Society (APS) and the American Association for the Advancement of Science, and as treasurer of the National Academy of Sciences.

Succeeding biologist Martha Krebs at the DOE, Dresselhaus will manage an office with



Top job – Dresselhaus

an annual budget of \$2.8bn, making it a major government sponsor of basic research. She plans, she says, to bring the physical sciences back to the same level of activity that they had relative to other sciences ten years ago.

Matthews, meanwhile, has served in several teaching and research posts since joining MIT's faculty in 1973. In one of the first experiments at the

medium-energy MIT–Bates Linear Accelerator, she discovered unexpected high-momentum effects that hinted at previously unknown correlations among particles in the nucleus. More recently, in experiments at the Los Alamos Meson Physics Facility, she found evidence for the transitory existence of the delta isobar in the ground states of nuclei.

Matthews will run the largest university lab of its kind in the US "I see my role as building on a very firm foundation left by my predecessor Robert Redwine," she told *Physics World*. She pointed to two specific challenges: ensuring the future of the Bates accelerator, which faces dwindling financial support, and making MIT "a principal player in the Large Hadron Collider".

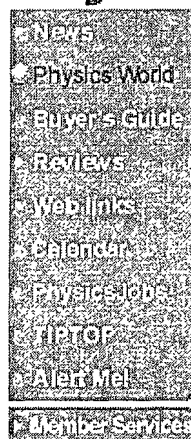
there is a chilly climate for women."

The AIP report puts forward two main explanations for the continuing poor representation of women in physics. One is harassment that ranges from discounting women's comments in science classes to "open hostility on the part of male students and faculty". Even MIT, which has a relatively large proportion of women in its science departments, admitted last year that female faculty members suffered discrimination. The other hypothesis suggested by the report is that "women do not perceive that a physics degree will help them achieve their career goals, which may be different from the career goals of men".

Physicists contacted by *Physics World* agreed that women's prospects can be improved

through strength of numbers. "Women in physics often find themselves rather isolated as graduate students or the only women faculty member in their department," explains Franz. June Matthews at MIT agrees, pointing to the lack of women at high-school and undergraduate level. "The major problem I have seen is the 'pipeline' that starts early in the educational process to encourage women," she says.

In fact, the pipeline is beginning to work. Czujko recalls helping to organize a conference ten years ago on recruiting women into physics. "Several of the students and young faculty members commented that it was the first time they had ever met a working female physicist," he said. "I don't think many students would make that comment today."



PhysicsWorld

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Collaborating with the enemy?

Gina Hamilton argues that female scientists must collaborate with their male colleagues if women are to overcome their natural instinct to reach consensus rather than scientific truth.

Author:

Gina Hamilton

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Overlooking female innovation in science

About a year ago I was asked to speak at a local women's studies conference on mathematics, science and technology. I didn't flatter myself at having been chosen, because nearly every local woman who was even vaguely involved with science or mathematics at a professional level had been invited to speak. Nevertheless, I had for some time been investigating female astronomers from the 17th, 18th and 19th centuries, so I volunteered to discuss my research.

What I had done was to read the diaries and correspondence of many female astronomers from the scientific revolution and to examine the written work of the people closest to them. The result of my research was a short paper entitled "Innovators or interpreters: the historic role of women in science." From this anecdotal data, I concluded that, historically at least, successful women scientists tended to collaborate with a male partner or partners, usually a close relative. The astronomer Caroline Herschel (1750-1848), for example, worked with her brothers William and John.

I also found that, because women were not admitted to university or to any of the scientific societies, this relationship with male scientists tended to be of the utmost importance to them. The female partner in the collaboration was entirely dependent on the male for access to libraries and to current scientific thought. She would also rely on the male colleague to help her to disseminate her work.

Finally, social dictates of the period created an atmosphere outside the collaboration that was challenging, to say the least. Society in general frowned on women in science, and other non-scientific women were especially cutting. A woman who embarked on such a career did so at the peril of being considered unladylike, immodest or worse.

The problem is that the work of the female partner in such collaborations has often been more closely identified with the male colleague than with the woman, with the result that the women's role

in the partnership has been eclipsed. Worse, the female scientists themselves consistently downplayed their own accomplishments.

I therefore concluded that the male/female collaboration of the period was the saving grace for women in the sciences. It also forced modern women to be far too modest about their scientific achievements - something that is all too common, even now, as we enter the new millennium.

The feminist backlash

I didn't think that my conclusions were particularly astonishing. So when the first wave of feminist reaction hit me, I was completely taken by surprise by the number and tone of e-mails from my female colleagues. Why wasn't I more supportive of female physicists? Why did I assume that women only succeeded if they collaborated with men? What about mentoring younger women scientists: isn't that working? And why did I cast women as their own worst enemies?

The real, unasked questions were even more insidious. Don't you know who the real enemy was? Don't you know who the real enemy is? Although I know what I am expected to say as a feminist - namely that men are entirely responsible for women's lack of recognition and success in science - I am afraid that I just cannot agree.

Many efforts have been launched, in the US and elsewhere, to increase the number of women studying science at university. Others aim to raise the level of awareness of women's accomplishments in physics. Some, like the effort by the University of California at Los Angeles to showcase 20th-century women in physics, are quite well done and thought-provoking. Its Women in Physics Web site reminds us that, while the number of women who are active in physics is still small, that percentage is increasing, and that women are doing important work in the field. Teachers can use the site to find women who have been overlooked (even in modern textbooks) and then present them and their achievements in the classroom.

However, these well-meaning attempts are often frustrated by the reality of the numbers game. No-one disputes the fact that far more men work in physics, mathematics and engineering than women. All of the department-shuffling in the world cannot alter the fact that, in spite of the best recruitment efforts in my own department - and in countless other physics and astronomy departments around the world - there is often only one female member of staff. The reason is not, as my sisters in science argue, because men are the natural enemy of women. There are simply not enough women with the right skills, especially in mathematical proficiency, who are interested in entering the field.

Into the classroom

Seven years ago I undertook a study in the US with Pamela Lanaro, an education specialist from the Northern California Education Foundation, who was convinced that the problem began at an early age. It is well known that up to the age of 12 or 13, girls and boys do equally well in maths and science, whether or not they study in single-sex or mixed classes. In fact, girls even appear to have a slight edge over boys.

According to the prevailing wisdom at the time of our study in 1993, it was believed that girls were somehow socialized to defer to boys, with the tacit encouragement of teachers, who favoured boys over girls. At middle-school level, when pupils are aged between 10 and 14, so the argument went, the impact on girls finally catalyses and girls give up. To test this belief we developed several exercises that were designed to demonstrate various abstract concepts in physics. We then tested how well the boys and girls in a mixed middle-school science class understood these concepts when they studied together, and compared the results with another group that had been split into boys-only and girls-only classes.

We expected to see a significant improvement in the performance of the segregated girls' class, and just a moderate difference in the performance of the other mixed and the boys-only class. What we saw instead was surprising. The performance of the integrated class improved (girls and boys alike), as did the boys' class. However, the segregated girls' class did not show any marked improvement at all. From my anecdotal observations I knew why. The girls - unlike the boys alone or the boy-girl partnerships - were constantly trying to find consensus. It did not matter to the girls if the answer was right or wrong; the important thing was that everyone agreed on the conclusion. They were afraid to argue with one another.

We were stunned. Most other studies at that time had shown that girls tended to do better in single-sex classes. The only major difference between our study and the others was that we had been working with a slightly younger group of girls and in a relatively large class. When Lanaro's subsequent studies produced similar data, we were left asking ourselves if sociological or biological factors affected girls' leap to abstraction. There is evidence that the answer is: "a little of both". Whereas boys at that age are making strides to stand out - in keeping with the biological and evolutionary imperative - girls are doing just the opposite and for the same reasons. For women there is safety in numbers, and bucking that trend, in nature, is courting disaster.

Timing may also have played a major role for the girls in our study. Our 12- and 13-year-old seventh graders were all within a year or so of the onset of puberty, and the biological and emotional changes that take place at that time are well documented. Unfortunately for girls, the onset of puberty coincides with the cognitive stage of human development at which abstract reasoning becomes possible. Boys, on the other hand, get a couple of years of blissful ignorance before

puberty rears its ugly head, which may give them the "edge" that we see in late middle school and high school. It may be that many girls cannot cope with these overwhelming biological, sociological and intellectual challenges simultaneously.

Understanding the problem is one thing; knowing what to do to correct it is another. We recommended that children should begin to receive algebraic concepts in concrete form and be taught mathematical modelling at much earlier ages, suggestions that are currently being considered for inclusion in the curriculum for fifth-year pupils in California. It will be several years before we know if the jump-start programme increases the number of women entering mathematics and science, but we have some hopes in that regard.

Collaborate and succeed

The truly interesting thing from our study, I found, wasn't in the test group at all. It was in the control group where boys and girls studied together, and it shed light on the dynamic nature of male-female collaborations. The girls in our control group, each of whom was made to partner a boy, improved their performance at more or less the same rate as the boys. When I went back to look at the performances of each of the partnerships, I saw, for the most part, little discrepancy between them. For some reason, each person in the partnership challenged the other - and both benefited.

I see this as being positive. Perhaps I am a little biased, because I am in a long-term male-female collaboration with my research partner and co-author David Madore. For the past two-and-a-half years we have been studying various apparent anomalies and symmetries in special relativity (see xxx.lanl.gov/abs/astro-ph/0001123). During that time, as with any close partnership, there have been times when we wanted to kill each other and occasions when we pushed each other so far away from accepted thought that we ultimately had to retreat, but we never, ever settled for the mediocrity of consensus.

Physics isn't a search for consensus; it is a search for truth. When the truth sometimes contradicts the long-held consensus - as both my recent work with Madore and my earlier work with Lanaro show - the researchers have to challenge each other not to fall back into the comfortable. Similarly, while Newton's work provided the fundamentals for all known physics, by the middle of the 19th century it was apparent that Newtonian mechanics was not the last word. Newton, however, was comfortable; Maxwell was not, which meant that the essential truth of the Maxwell equations was systematically overlooked for almost 50 years. Working on the edge of known truth is not a comfortable place to be. To work through it, and arrive at whatever new truth is there, a dynamic collaboration is necessary.

Whatever the gender make-up of the partnership, the important thing is for all members within it to challenge one another actively and

constructively. Women may have an added burden. Although our evolutionary background encourages us to concede, to agree and to create consensus, our duty as physicists is to challenge known thought and to arrive at new and unimagined truth. We also have a higher duty, as humans speaking for humanity, not to hide behind our feminine modesty but to tell the world what that new truth is.

The key to this is collaboration. We must create collaborations that will challenge not only our own abilities and sensibilities, but also those of the scientific community and the world at large.

Do you have any comments on this forum? Why not email *Physics World* at pwld@ioppublishing.co.uk

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RECIPES & GIFTS



Tuesday, July 11, 2000



cybercoverage

Michelle Thaller

Women in Science: A View From the Trenches

Summertime has rolled around again, and lately I've been completely engulfed in that traditional summer ritual, the professional astronomy conference. About every six months (deliberately scheduled to coincide with summer and winter breaks) astronomers from all over the world gather to discuss the year's developments, debate new theories and marvel at new discoveries.

A lot of the real work of astronomy goes on here; collaborations are formed, deals are struck, rivals are met. These meetings used to thrill me. Of course they were interesting scientifically, but it was also a chance for me to network and flirt, enjoying a chance to show off my social skills. And I had a huge advantage here -- I'm female.

Simply being a young and attractive woman got me attention. At first, being a woman in science was a heady experience. I, like many women students, had struggled a bit through my education, but here I was, a newly minted Ph.D., and everyone's eyes seemed to be on me. I felt very optimistic about my status and chances of success in my chosen profession.

Last week I had a chance to share a meal with a wonderful young woman named Scarlet, an astronomy student at Cornell University. She had come all the way to Rochester, N.Y., (this year's American Astronomical Society meeting) to talk to me about her interest in an astronomy career. We sat down to a lovely meal and talked about everything from surviving physics classes to taking full advantage of the college dating scene.

Science Tidbits- Archive of Recent Columns

Michelle Thaller, an astrophysicist, works for NASA in Los Angeles, California.

Send Michelle an [e-mail](#).

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During our talk, I looked over at this beautiful, talented, energetic young woman who was so ready to take on the challenges of science. I exactly remembered that wonderful feeling of wide-open potential, and I wondered what had happened to it. What had happened to me?

I honestly didn't know what to tell Scarlet about a career in science. Part of me wants to be the total cheerleader -- you go get 'em girl! You can set this field on fire if you aim high enough and stick to your dreams. But part of me wants to caution her too, tell her about the ongoing struggle I've had in this line of work. Tell her how you never get to rest, never get to fit in, never get to feel like you're good enough.

Let's start by stating the obvious: a career in science is not easy for anyone. Astronomy is a competitive, high-pressure profession. At every step in a typical science career: going from graduate school to a post-doctoral research fellowship, to a tenure-track position, to a full professor, many people are weeded out.

And the cuts are not only made by judging the quality of an astronomer's science, but also how many papers he or she publishes, what kinds of collaborations he or she taps into, and -- often most important -- how much grant money he or she brings in. It's a profession that favors aggressive, politically astute, independent people. Still, both men and women find this attractive. Do they really have the same chance, if they're willing to play by the same rules?

That's not a simple question to answer. Like it or not, men and women are socialized differently. This really hit me in the face when I began to study physics at Harvard. Now, I am not a shy person. I'm a natural extrovert, and I don't shy away from a good argument (I was a debate champion in high school). But when I got to Harvard, I found the atmosphere of the science classes very hard to handle.

I was often the only woman, or one of a few, in my classes. No problem, I thought. I'd always gotten along well with guys, and in fact had formed much closer friendships with men than women. But I was totally unprepared for the level of aggression in the science classes.

A typical study session involved a bunch of guys standing around a chalkboard yelling at each other. One student would start a problem, while the others would loudly comment that they were going about it all the wrong way and why didn't the group do it their way instead? The guys seemed to relish this rough-and-tumble way of working, but I found when I took the chalk in my hand, I would freeze.

The guys would start their usual taunts, and I just couldn't concentrate. I realize now, and I did to some extent then, that the guys didn't mean anything personal by this. It wasn't because I was a woman they attacked anyone who happened to be doing the physics problem. But like a typical female in a science class, I shrunk to the back of the classroom and never said another word the entire semester.

One high-minded professor had noticed that all his female students (including me) were hiding in the back of the room and not raising their

hands, so he specifically sat us all in the front row and individually asked us questions about the lessons, whether or not we raised our hands. I dropped the class.

I still feel pretty bad about this. I think that if I was stronger, more confident and assertive, I wouldn't have had those problems. After all, none of it was directed at me as a woman. And things are so much better for women in science now than in the past, where women were often turned away from observatories because there weren't any women's rest rooms (true!).

But the basic problems still exist in me today. I don't really know how to fit in with the guys, or more to the point, get them to accept me. I try really hard. I've gotten used to (although it still hurts) combative questions about my worth as a scientist, getting no praise from my superiors, and having no one at work remotely interested in chatting about my personal life.

The last point is more painful than you'd think. Women routinely talk about their lives as a way of reinforcing bonds between them. When someone asks about your house or your husband, you feel they approve of you. Without that, I can't help but feel that my workplace is rather cold. And there are also a thousand and one small stabs at my ego: routinely being mistaken for a secretary, being called "Michelle" in a meeting where everyone else is addressed as "Doctor," and generally being dismissed and ignored by the big boys. But I should be able to deal with all that, shouldn't I?

In the end, being a scientist, I know never to believe anecdotal evidence. I may think it's grindingly tough to stay in science, but another person may point out that women actually get special preference and support. What do the actual facts say? I made some effort to find out whether my problems were all in my head, or whether there were real statistics to back my experiences up. I found an article by Meg Urry in a publication called STATUS, which is put out by the American Astronomical Society to address the special issues women face in astronomy and physics.

Here are the facts, according to Urry: Only about 5 percent of full professors or the equivalent rank of research astronomers are women. This makes some sense, because when those women were in graduate school in the '60's, almost no women went into science. The small percentage isn't really any proof of discrimination, once the women got their feet in the door.

So what's happening today with students fresh out of school? The good news is that almost 25 percent of astronomy graduate students today are women. That's a huge improvement from the past, but unfortunately, the number of women in science takes a real beating right after graduate school. Women in grad school have only a 26 percent chance of landing that first job after they get their Ph.D.'s, as opposed to a 43 percent chance for their male colleagues.

The trend continues for each level of promotion. As Urry puts it, "... the

progress of women lags behind at all levels. Women are less likely to be hired, are less likely to be given tenure, and spend longer time at lower levels than their male colleagues." To make matters worse, this lag is happening at a time when the field of astronomy is expanding, well, astronomically. In the last five years, the number of assistant professorships has increased by 50 percent, and full professorships by 20 percent. What the heck is going on?

I feel that I have never been deliberately discriminated against. I was never told that "girls can't do science." I was never sexually harassed by a professor, or had so much as an honestly unkind word from a co-worker.

But I've learned that when professors consider who will eventually replace them and take over the reins of science, it's far easier to see young versions of themselves in the cocky, aggressive male students than the quiet, strangely different young women. I've seen this happen over and over, and I'm getting tired of constantly having to prove them wrong about me, constantly having to argue for my worth.

I could never regret the wonderful career this has been. I love this job, and I love the way it's forced me to grow. But think hard about this, Scarlet. You may never, not for a moment, be allowed to feel like you really belong.

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