V. Other documents

Gender issues

In physics and astronomy, the gender balance is traditionally skewed towards male researchers. This is a highly unsatisfactory situation, both for the women in the field, our working environment, but most of all for the lack of diversity caused by one dominating gender in the field. The problem we want to solve is thus to correct this while maintaining the highest standards of excellence.

Current situation

If we look at current situation in the groups participating in this proposal, the fraction of the personnel with a PhD that are women are shown in Table 1. Hence, in total, we currently have 6 women and 25 men with a PhD, i.e. the fraction of females is 19%. Among the PhD students in the involved groups though, the fraction of females is essentially 50%, which agrees with the trend towards a progressively more skewed gender distribution at more senior positions.

Group	Professors (female / male)	Researchers & Associate professors (female / male)	Junior researchers / postdocs (female / male)	Total (female / male)
SU Astronomy	0 / 2	1 / 5	0 / 2	1 / 9
SU CoPS	0 / 2	0 / 1	2 / 1	2 / 4
SU High energy physics	2 / 2	0 / 3	0 / 2	2 / 7
SU IceCube	0 / 2	0 / 1	1 / 0	1 / 3
KTH Particle Astrophysics	0 / 1	0 / 1	0 / 0	0 / 2
Total	***2 / 9***	***1 / 11***	***3 / 5***	***6 / 25***

Table 1. The current gender balance of personnel with a PhD at the groups participating in this proposal. Junior researchers are 4-year postdoc-like positions ('forskarassistent').

Goals within five years

In a longer perspective, our goal is to achieve a gender balance of at least 40/60, i.e. at least 40% of the gender that is subdominant. This goal coincides with the goals of Stockholm University. However, given the skew gender balance at the moment, it is not realistic to expect to achieve this goal within five years. Hence, our goal for the coming five years is that at least half of the new recruitments (both at the associate professor, junior researcher/postdoc and graduate student level) should be female. The forerunner of this project, the HEAC centre, has hired 10 PhD students, of these 5 were female, so within that centre we have managed to live up to a similar goal.

How to achieve these goals

How do we then achieve these goals? Several studies indicate that one important factor in conserving gender imbalances is a non-transparent recruitment process [1,2]. The investigation carried out at the Physics Department of Uppsala University [2] showed that for PhD positions, informal procedures where personal connections and initiatives are important tend to disfavour female students while formal open announcements lead to a more balanced recruitment of graduate students. The same holds true for Master Thesis work and similar openings. This has been recognized by the science faculty at the university, which recently strengthened the formal requirements on the recruitment process of post-graduate students. Even before this the internal rules at our respective departments fulfilled these.

Hence, we will make sure that all announcements for Master and PhD students are as open and formal as possible in order not to introduce biased selection mechanism

In addition it is important to make sure we make a very good survey of potential candidates for the higher positions and try to target the areas and fields where strong female candidates exist. This of course has to be done in conjunction with our overall scientific goals for recruitment (that is to be decided upon with the help of the International Advisory Board, IAB). We will also use the opportunity that the University offers, that we can invite female candidates to apply

For junior researchers, we will use a similar strategy of targeting areas where we know there are strong female candidates and invite these explicitly to send in their applications. To ensure an increased fraction of females at the higher (permanent) levels, we can use the possibility to hire promising female junior researchers as an associate lecturer ('biträdande lektor', which is as close as we can get to a tenure track system in Sweden) provided this can be agreed with the chair of the department concerned.

For postdocs and PhD, we will also use the same strategy, but here (of course), the option of having the positions as tenure track positions is not viable.

For all of the announcements mentioned above, we can also use a possibility to extend the deadlines of applications for the positions in case it turns out that too few female candidates have applied.

Of course we will also adopt and follow the gender plan of the departments involved and the overall gender plan of the University. These e.g. state that we always have to state in openings that we especially welcome female applicants as these are under-represented at the department . It is also crucial to announce all positions as widely as possible to get international applicants, which tends to increase the fraction of female applicants

The effort does not stop with the recruitment process. Unintended prejudices and practices, both from males and females amplify present imbalances [3], and the psychological mechanism which can cause members of a group subject to negative stereotypes to underperform, labelled "stereotype threat" by Steel [4]. We will try to identify and counteract such mechanisms in collaboration with the gender equality groups of our respective department. We will actively promote female leadership and academic performance, for instance by ensuring that the guest-researcher programmes, seminars and colloquia feature a healthy proportion of female scientists. We will also have a "gender forum" where gender issues will be discussed within the CPC to make an "active" issue for all our members.

Why do we think this would work? The main reason is the success of the PhD positions announced within the HEAC Centre. As mentioned, 5 out of these 10 positions were filled with women. These positions were announced much more internationally than is usual for PhD positions in Sweden and we got about 250 applications for these 10 positions.

If we reach our goals of at least 50% of the new hirings being women, we could after 5 years expect to have 3 out of 5 new research associates being women. We could also expect to have 3 out of 5 new postdocs as women. For graduate students, it seems likely that we should also expect about 3 out of 5 of the positions to be filled with women. For associate professor, we hope that at least one out of the two new positions will be a woman. Five years from now a few of the current postdocs and research associates will have finished and to summarize we therefore expect to have increased the number of females from 6 to 10, while at the same time, the number of men would remain at 25. The fraction of females would then be 29%. This is still not at the long-term goal of at least 40% women, but this is the most realistic scenario we can image building up a larger fraction of female researches within the project.

To ensure that the younger women we have at present in the field do not leave before reaching a tenured position we will, with the help of the faculty and the University, give help in career planning. We will also encourage participation in the networks of female physicists that is presently starting to operate in

Sweden.

It is also worth noting that e.g. at the astronomy department, the fraction of female undergraduate and graduate students have increased steadily over the last year, so the recruitment base for higher positions (at least from a local perspective) is increasing. This is indeed very promising for the future.

References

1. C. Weenrås and A Wold 199 Nature 387 341.
2. A. Lundborg and A. Schönning, Maskrosfysiker, 2006, http://www3.tsl.uu.se/~lundborg/maskrosfysiker.pdf.
3. R. Goldberg 1968 Trans-Action 5 267
4. C Steele 2004 Steele Discusses "Stereotype Threat"

Outreach

The quest for understanding the Universe is appealing not only to scientists, but also to the general public. Our respective research groups and departments have a wide spectrum of outreach activities. Members of the CosmoParticle Collaboration, CPC, are very active and have initiated many of these. The public outreach is - and will be - conducted on many different arenas to target different audiences.
Our research is presented to the public in a number ways including the science exhibition one day every autumn in a central park in Stockholm (Kungsträdgården), evening lectures for the public, participation in science exhibitions, science summer schools, the AlbaNova "open day", etc. Members of CPC are the driving forces behind many of these activities. Models of the AMANDA neutrino telescope (in scale 1:250), built at Stockholm University, have been on display at the Adler planetarium (Chicago), the Ice Hotel (Jukkasjärvi), the Museum of Technology (Stockholm) and several large science exhibitions in Sweden.
At the university we have a long tradition of offering popular evening courses aimed at the general public, for example courses as *Modern Cosmology* (Fransson), *Good and bad science* (Hulth) and *Physics for Poets* (Bergström).
Each year our departments co-arrange teacher days, *Lärardagarna*, with the Royal Academy of Sciences, inviting schoolteachers for lectures by active scientists. Another activity targeted towards pupils and teachers at primary school is the House of Science (HoS) situated on the campus of the AlbaNova University Centre. Numerous teachers with students from different places in Sweden visit it every year. The HoS was founded by one of the members of the CPC research groups, E. Johansson, who served as its director for many years. There is strong cooperation between HoS and AlbaNova staff, including the CPC research groups, exemplified by the fact that three scientists from the Department of Astronomy work part time (>50%) there.

One recent outreach project, initiated by M. Pearce of the CPC, is the Stockholm Educational Air Shower Array (SEASA) project which is run by the HoS and the KTH Astroparticle Physics group. The focus of the project is the study of high energy cosmic ray showers using a network of time-synchronized cosmic ray detector stations established during 2005 at participating schools in the Stockholm region. To date, approximately 30 high-school students have completed project works. The project has attracted significant interest in the Swedish press that has resulted in a queue of schools from all over Sweden wishing to join the project.

Students building cosmic ray detectors for the SEASA project.

Another well known project with strong involvement from CPC physicists is Hands-on-CERN (winner of the 2005 Webby-award in the science and technology category), an interactive web-based tool through which school-classes and other interested persons can learn about particle physics and analyze real data from the Delphi experiment. Presently there is intense development work for a follow-up using the ATLAS experiment once data become available (ASEC). E. Johansson chairs the EPS EPOG committee and is convener of ATLAS outreach activities.
Clearly, we will continue the extensive efforts already started – but also believe that more coordinated public outreach activities would be useful. We envision days targeted for science journalists and special summer schools for teachers. The latter will be in continued collaboration with the HoS, where some of our Linnaeus-funded PhD-students will work as assistants. Our WWW-site will have a special entry for media and for the public, and we will earmark some of the grant for coordinating and performing these public outreach activities.

Popular-science description of the project (English version)

The universe is more complex than we ever imagined. New findings the past decade have changed our views of what the universe is made of – and change the way physicists think about the world around us.

From astronomical observations we now understand that the normal atoms only constitute a small fraction (about 4%) of the universe. Most of the universe is instead made up so called Dark Matter and Dark Energy, and understanding what these dark components of the universe really are is now the prime task, not only in astronomy, but in Science as a whole. The CosmoParticle group is formed since we believe that attacking these questions requires many different approaches – and here we join forces between astronomers, astroparticle physicists and particle physicists, who work in the stimulating environment of the AlbaNova University Centre, formed in new buildings six years ago. Unveiling what the Cosmos is made of will also help us clarify our present picture of how normal matter works, especially in some of the most energetic processes known.

Dark Matter was discovered by astronomers already in the 1930's, but only more recently has it become evident that most of the gravitational pull is made up of something completely different from normal atoms. The astronomers see the signs and consequences, but to understand what makes up the Dark Matter requires help from particle physics. It is now believed that the Dark matter is likely made up of hitherto undiscovered particles – and that there are ways to find that particle species! In that quest, astronomers and physicists are building the largest and most sophisticated experiments on Earth – and in Space. The CosmoParticle collaboration is participating, for example, in the construction and running of the amazing IceCube experiment, a detector placed kilometers deep in the Antarctic Ice. The new huge ATLAS detector in the CERN tunnel under Switzerland and France, housing the Large Hadron Collider – equipped with the world's largest system of superconducting magnets – is another way to create and investigate particle candidates for Dark Matter. In space, astronomers and physicists from KTH and SU will also use the PAMELA and GLAST satellites to search for the signs of dark matter particles. There is a widespread anticipation that answers may be around the corner, and it is clear that whatever dark matter is – it will revise the standard model of particle physics.

Dark Energy is even more elusive. Although this in fact what makes up most of the energy content in the universe today, we have little understanding of its nature. The evidence comes primarily from astronomical observations of distant supernova explosions, which show that the expansion of the universe is speeding up. This acceleration is pushed by the negative pressure of what we call Dark energy. Supernova explosions will remain one important way to probe in more detail how dark energy works, and the CosmoParticle collaboration include members of the major international supernova cosmology groups, but also astronomers with detailed knowledge of the physical mechanisms behind supernova explosions. This work and complementary probes on how Dark energy affects astronomical observations – will slowly shape our picture of the elusive Dark Energy. The main question is if it is a truly con-

stant energy density of empty space – Einstein's cosmological constant – or if its nature can be revealed by observing a time or spatial dependence.

The **CosmoParticle Collaboration** will try to tie all these links together. The synergy effects are quite obvious, but have not yet been fully exploited. Astronomers will work together with physicists to analyze the signals expected from the next generation experiments that we participate in. Fundamental theory will have to guide observers and experimentalists in their design of future experiments.
The aim of the next decade is thus no less than to understand what the universe is made of. In learning about Dark Matter and Dark Energy it is also clear that the current fundamental theory, and the particle physics standard model, will have to be revised – simply because there is no room for the dark components in it. The possible results of the CosmoParticle project might therefore have consequences not only for how we perceive the universe at large, but also for our understanding of the microcosmos, and of ourselves.

Existing Personnel

SU Astronomy Group

Björnsson, Claes-Ingvar, 56, Assoc prof, Theorist, works on high energy astrophysical plasmas

Fransson, Claes, 56, Professor, theoretical and observational studies of supernovae and GRB, observational cosmology, PI of HEAC, JWST

Kozma, Cecilia, 45, Researcher, theoretical modeling of supernovae spectra

Larsson, Stefan, 53, Researcher, x-ray and gamma-ray observations of compact objects, INTEGRAL and GLAST

Lundqvist, Peter, 49, Professor, observations and modeling of circumstellar emission of supernovae, pulsars

Mellema, Garrelt, 41, Assoc prof, hydrodynamical simulations of reionisation

Mörtsell, Edvard, 36, Junior researcher, supernova cosmology, cosmological parameters, gravitational lensing

Sollerman, Jesper, 39, Assoc prof, KVA researcher, supernovae observations and cosmology, GRBs

Östlin, Göran, 38, Assoc prof, VR researcher, observational cosmology and extragalactic astronomy, JWST

1 postdoc (male)

12 graduate students, of which 6 female

SU Cosmology, Particle Astrophysics and Strings (CoPS) Group

Marcus Berg, 34, Junior researcher, string cosmology and string-inspired particle physics.

Lars Bergström, 55, Professor. Theorist, member of the GLAST working group for dark matter and new physics.

Jan Conrad, 34, Junior researcher, experimentalist, leader of the GLAST working group for dark matter and new physics.

Joakim Edsjö, 38, Docent, VR Researcher, Lecturer. Theorist. Develops the DarkSUSY code. Member of the GLAST working group for dark matter and new physics.

Ariel Goobar, 45, Professor. Experimentalist, member of the Supernova Cosmology project, and the JDEM/SNAP collaboration.

3 postdocs (2 female)

10 graduate students (2 female)

SU IceCube Group

Per Olof Hulth, 64, Professor. IceCube executive board; WIMP search convener; Outreach.

ChristianWalck, 57, Docent, Search for WIMP annihilation; Reconstruction of high energy events in IceCube.

Klas Hultqvist, 51, Professor. Search for Solar WIMP annihilations; Neutrinos from extreme objects; Outreach.

Seon-Hee Seo (F), 37, Junior researcher. Searches for WIMP annihilations and high-energy (tau) neutrinos; Extreme objects.

4 graduate students (1 female)

SU High Energy Physics Group

Christophe Clément, 35, VR Researcher, Lecturer. Coordinates search for SUSY as an excess in the dilepton + jets channel.

Sten Hellman, 51, Professor. Group coordinator, dectection and characterisation of meta-stable heavy particles.

Erik Johansson, 62, Professor (partially retired). Outreach, dectection and characterisation of meta-stable heavy particles.

Kerstin Jon-And (F), 58, Professor. Search for deviations from the Standard Model using inclusive dilepton data.

David Milstead, 37, KVA Researcher, Lecturer. Coordinates the activity towards dectection and characterisation of meta-stable heavy particles.

Torbjörn Moa, 54. Research engineer. Search for SUSY as an excess in the dilepton + jets channel.

Jörgen Sjölin, 39, Research Assistant. Coordinates the search for deviations from the Standard Model using inclusive dilepton data.

Barbro Åsman (F), 59, Professor. Search for deviations from the Standard Model using inclusive dilepton data.

1 postdoc

5 graduate students (2 female)

KTH Astroparticle Physics Group

Mark Pearce, 37, Professor. Group leader. Leader of the Swedish involvement in the PAMELA and PoGOLite experiments.

Felix Ryde, 37, Swedish Space Board Researcher. Member of the GLAST GRB working group.

1 postdoc (from 2008)

6 graduate students (3 female)