

Five-year Hiring Plan for Particle Physics at Northwestern University

David Buchholz, Andre de Gouvea, Heidi Schellman, Michael Schmitt, Mayda Velasco

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In our opinion, the main interesting research opportunities in particle physics can be summarized as follows:

1. neutrino properties. We are particularly interested in extending the neutrino program into neutrinos oscillation reactor experiments and neutrino-less double-beta decay as particularly exciting possibilities. Of equal interest to neutrino physics is the connection to particle astrophysics;
2. physics beyond the Standard Model at multi-TeV colliders. The LHC program will be of great importance in probing fundamental aspects of elementary particles and their interactions, violations of fundamental symmetries, and the nature of space-time;
3. non-accelerator-based experiments, such as the terrestrial search for dark matter particles and measurements of the neutron electron dipole moment. These will complement items (1) and (2).

Given all the known “difficulties” of the Standard Model, it will be absolutely necessary to search for “new” physics with several experimental techniques, and for that reason all three areas should be pursued.

Based on our research interests, availability of funds and opportunities of collaborating with non-particle physicists, we would like to propose that the following areas should be pursued by our department:

- theoretical physics. Our main interest is on the phenomenology for models of physics beyond the Standard Model. Also relevant are:
 - links to cosmology (strong in Chicago area).
 - links to string theory (pursued in our math department).
- non-accelerator-based searches and precision measurements, with special interest on physics using experimental techniques at present more commonly used in condensed matter, atomic, molecular and optical science:
 - neutrinos (magnetic moments, oscillations, etc.).
 - symmetry test (EDM, CPT-test, etc.).
 - searches for dark matter.
- experiments at colliders:
 - LHC – besides particle physics, there are other areas of research like quark-gluon plasma in heavy ion collision with the CMS detector.
 - ILC – in Illinois...we hope. There are not enough resources to invest in an accelerator physicist, but we would like to offer courses on this subject every other year.

How many faculty positions and what time scales are we thinking about?

- Two theorists – within 1-4 years.

- Two non-accelerator based experimental particle physicists – within 2-4 years.
- One collider physicist – 2009-2010.

How could we achieve this?

- joint appointments with labs in the area and other departments at the university.
- bridge(s) with retirements - we have four members in the high energy and medium energy groups that are at least seventy years old. This number includes both theoretical and experimental faculty.

Possible Joint Appointments with ANL High Energy Division

In theoretical physics:

- a new tenure track position at NWU and ANL splits a current position could turn into:
 - 1/2 position NWU, 1/2 position ANL for existing ANL theorist.
 - 1/2 position NWU, 1/2 position ANL for new hire for theory.
 - Andre de Gouvea visiting scholar at ANL.
- 1/2 position at NWU granted and 1/2 ANL granted could turn into:
 - 1/2 position NWU, 1/2 position ANL for new hire.
 - Andre de Gouvea visiting scholar at ANL.
 - existing ANL theorist becomes adjunct professor at NWU.

In experimental physics:

- non-accelerator-based neutrino oscillations – reactor experiment.
- astrophysics – we are not likely to participate in current ANL-High Energy division projects, but could find a common ground in topics like dark matter.

Combined experimental and theoretical investment:

- a new tenure track position at NWU granted and ANL splits a current position could turn into:
 - 1/2 position NWU, 1/2 position ANL for new hire for reactor experiment.
 - 1/2 position NWU, 1/2 position ANL for existing ANL theorist.
 - Andre de Gouvea visiting scholar at ANL.

Possible Joint Appointments with ANL Physics Division

We are interested in the Rare Isotope Accelerator (RIA) program and the precision measurements made with ion trapping. At this time it is not clear how to make a joint appointment in these two areas.