

**On the Need for a New Non-Programmatic Funding Channel
for Postdoc Centers in Theoretical Astrophysics**

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The early education and training of the current generation of young theoretical astrophysicists can be traced to a small number of select research centers. In the US these centers include the Institute for Advanced Study (IAS) at Princeton; the theoretical astrophysics centers at UC Berkeley, Caltech, and Princeton; the Kavli Institutes at the University of Chicago, MIT, Santa Barbara, and Stanford; and the Institute for Theory & Computation (ITC) at Harvard University. Below I argue for the need to establish a new funding channel for postdoc centers in theoretical astrophysics. I will substantiate my argument based on the example of Harvard's ITC, which I know first hand in my capacity as its director.

The ITC has an annual budget of the order of \$1M which supports a steady group of ~ 25 top-quality postdoctoral fellows and ~ 25 students. The intellectual life of the ITC includes an extensive visitor program which brings speakers for several weekly seminars, a weekly pizza lunch on a broad theme (such as "Plasma Astrophysics" or "Modified Gravity"), and informal discussion forums - most prominently the ITC luncheon, which is regularly attended by ~ 60 astrophysicists from the area. For more details, see <http://www.cfa.harvard.edu/itc/>.

The young theorists at the ITC work on a broad variety of topics ranging across planetary science, high-energy astrophysics, and cosmology. The brightest postdocs flourish in an open environment in which they are not instructed to work on a particular subject or follow a particular agenda. I started my career as a postdoc in a similar non-programmatic group led by John Bahcall at IAS, Princeton. During my time there, this group included Jeremy Goodman, Andy Gould, Lars Hernquist, Marc Kamionkowski, David Spergel, Fred Rasio, Hans-Walter Rix, & David Weinberg. Many others, including Charles Alcock & Scott Tremaine, were there before I arrived, and Daniel Eisenstein, Wayne Hu, Eliot Quataert, Max Tegmark, Eli Waxman, & Matias Zaldarriaga joined this group after my departure. From my experience at Princeton and Harvard over the past two decades, I have observed

that a non-programmatic environment is a pre-requisite for creative work, and is **required** in order to produce the best grooming grounds for future generations of both theoretical and observational astrophysicists. In such an environment, postdocs who start with expertise in a particular area might end up making their most important contribution in a very different area. Notable examples from the above list include people who started as theorists and ended up as observers, such as Charles Alcock, who pioneered the MACHO microlensing experiment and is now the director of the Harvard-Smithsonian CfA, and Daniel Eisenstein, who discovered baryonic acoustic oscillations in the SDSS data and is now the director of the SDSS-III collaboration. The best postdocs should not be confined to a specific research agenda dictated by funding agencies in a way that prevents them from developing the freedom of mind that enables them to open up new frontiers.

Because of the diverse nature of a center like the ITC, there cannot be a unifying programmatic theme that will apply to all of its members. Unfortunately, the available funding opportunities for centers like the ITC are restricted to programs which require a scientific focus. As director of the ITC, I have experienced difficulties in obtaining funds from the existing grant programs at NSF since new grants are expected to be targeted at particular science objectives. For example, the *Physics Frontiers Centers* program of NSF requires a scientific focus and does not provide support for diverse centers.

The nature of existing funding opportunities stands in contradiction to the nature of the above-mentioned centers which encourage free, creative thinking and the cultivation of a diverse range of interests.

Alternative short-term funding through the host institution or donors (the model on which the ITC is currently based) is usually available for partial support and is often subject to unpredictable circumstances. In today's funding climate it is extremely difficult to establish long-term, stable funding for new centers in this way.

The above-mentioned centers are essential for the health of Astronomy & Astrophysics in that they groom the young generation of leaders who will inspire new observational projects. The importance of these centers is evident based on the history of the field over the past few decades.

The purpose of this white paper is to alert the decadal survey committee to the mismatch between existing funding opportunities and the needs of the

above centers. The budgetary requirements of these centers are relatively mild compared to the cost of the observational programs that would benefit from the people educated in these centers. It would therefore be most appropriate that a new, non-programmatic funding channel for postdoc centers be established by a federal agency.