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Research Associateship Programs
The National Academy of Sciences
500 Fifth St. N.W.
Washington, DC 2001

Dear Colleague,

It is a distinct pleasure to nominate Takanori Sakamoto for an NRC Fellowship at Goddard Space Flight Center. Taka is a young scientist of truly exceptional abilities and accomplishments, who has made important contributions to the field of gamma-ray bursts (GRBs). He ranks among the very best graduate students that I have known in thirty years of teaching and research. Indeed, he was one of only a *very* few graduate students who were selected to give oral talks at the Santa Fe GRB Workshop, which was held last September and which was attended by more than 250 scientists from around the world.

I have known Taka since he joined the High-Energy Transient Explorer – 2 (HETE-2) Science Team in 2000. He is highly intelligent, able, careful, and energetic. He has a strong foundation in physics and a broad knowledge of astrophysics. Three of Taka's greatest strengths are his independence, his excellent physical intuition, and his instinct for tackling important problems. He has an outgoing and warm personality, and he is fluent in English – having spent nearly a year as a graduate student fellow at Los Alamos National Laboratory under the supervision of Ed Fenimore.

Taka has made vital contributions to the HETE-2 mission. He was responsible for calculating the detector response matrices (DRMs) for the Wide-Field X-Ray Monitor (WXM). This was no trivial matter because the X- and Y-detectors are each comprised of six anode wires, and the properties of the detectors vary along each wire, as well as from wire to wire. In addition, the shadowing produced by the coded aperture mask, and the support structure for the mask, had to be modeled in detail. Taka took charge of calibrating the DRMs using an extensive series of observations of the Crab nebula (whose spectrum is constant and known) at a grid of points in the WXM field of view.

Frankly, it is Taka's work in calculating and calibrating the WXM DRMs that has made possible the very exciting results about GRBs, and especially the X-Ray Flashes (XRFs), that the HETE-2 mission has obtained. After calculating and calibrating the WXM DRMs, he immediately took the lead in using them to analyze the spectra of GRBs and XRFs. Indeed, Taka (with assistance from Tim Donaghy, Carlo Graziani, and myself) has carried out essentially *all* of the spectral analyses of HETE-2 bursts involving joint fits to the WXM and the French Gamma-Ray Telescope (FREGATE) data. He has now completed the spectral analysis of more than three dozen bursts. This work will be reported in a series of papers that will shortly be submitted to The Astrophysical Journal; on each of these papers, he will be the first author.

The scientific highlights of Taka's work (and of the HETE-2 mission) include:

- Demonstration that the spectrum of XRF 020903 peaks at an energy below ~ 4 kev – making it the most extreme XRF observed by HETE-2 so far. This result stands is stark contradiction to the claim made by many earlier authors that the spectral peaks of GRBs lie in a narrow range around ≈ 250 kev.
- Confirmation of the $E_{\rm iso} - E_{\rm peak}$ relation found by Amati et al. (2002) for GRBs, and evidence that this relation extends to XRFs (i.e., that it extends over *five decades* in $E_{\rm iso}$). [Here $E_{\rm iso}$ is the isotropic-equivalent energy of the burst and $E_{\rm peak}$ is the energy of the peak of the burst spectrum in νF_ν, both measured in the burst source frame.] This result provides strong evidence that GRBs and XRFs are the same phenomenon, and suggests that XRFs may provide unique insights into the structure of GRB jets, the GRB rate, and the nature of Type Ic supernovae.
- Tantalizing evidence that $E_{\rm iso}$ increases strongly with redshift (i.e., that GRBs evolve strongly with redshift). If confirmed, this result would have profound implications for the nature of GRBs, the nature of GRB progenitors, and the use of GRBs as a probe of cosmology and the early universe.

A primary goal of the *Swift* mission is to determine the nature and the origin of GRBs. Taka proposes to use the uniquely powerful capabilities of *Swift* to understand the $E_{\rm iso} - E_{\rm peak}$ relation, a relation that has profound implications for the nature of GRB jets, the radiation mechanism that produces GRBs, and the central engine the powers the bursts.

As Taka has written, an NRC Fellowship at Goddard Space Flight Center under the supervision of Dr. Neil Gehrels, PI of the *Swift* mission – which is scheduled for launch later this year – is the ideal place and time for him to pursue the important postdoctral research program that he proposes to do. Taka's exceptional abilities, knowledge, and experience position him perfectly to exploit the data from the *Swift* mission to accomplish this program. For all of these reasons, he is a truly outstanding candidate for an NRC Fellowship at Goddard Space Flight Center, and I give him my highest recommendation.

Don Q. Lamb

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of Astronomy and Astrophysics
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