Usage Report for Fiscal Year 2017

Project Title:

Supernova remnants: from the explosion to the interstellar medium

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Background and purpose: Supernova remnants (SNRs) are key in the cycle of matter in the Galaxy. The purpose of my research is to reveal the mechanisms that shape SNRs, from their generation in a supernova explosion to their dilution in the interstellar medium. I want to elucidate how different explosion engines produce different SNRs, and how SNRs interact with their environment – and how these effects play together, including efficient particle acceleration, to reach a complete understanding. Because of the complex multi-scale physics involved, this study requires the use of state-of-the-art numerical simulations. I am building upon a framework I have already developed. I am running 3-dimensional time-dependent simulations to properly reproduce the SNR geometry.

Usage: The project overall has made progress, we have obtained simulations data from supernova explosions made by German colleagues that we are now using to make our SNR simulations. However adapting the code to the new initial conditions took longer than anticipated, and the code testing was done on a smaller computing cluster acquired by the iTHEMS project at the beginning of the fiscal year. This was sufficient because the input data we have are not at high resolution. So we have not used the Hokusai super- computer yet.
Except that since a new system was installed, we have re-done simple tests on both the GreatWave and the BigWaterfall computers.

Prospect: The production runs are expected to start in the coming weeks, to compare the SNR evolution under different conditions. For this we plan to use mostly Hokusai.
In the second phase of the project later this year, we will compute the ionization and thermal emission from individual species in the supernova ejecta, to compare with X-ray observations. Then we will make use of the larger memory per core available on the new BigWaterfall computer.