SoLAr DYnAmo

Over the past few years, Juri Toomre and graduate student Benjamin Brown at the University of Colorado, Boulder and Mark Miesch at the National Center for Atmospheric Research (NCAR) have used PSC’s LeMieux and BigBen for very large-scale simulations of convection in the deep interior of stars. The convection patterns they model, known as giant cells, influence solar magnetic storms that can affect satellites and electrical systems on Earth.

In the solar interior, convection occurs as hot plasma rises and cooler, more dense plasma sinks. In this convection zone, from about 70–percent of the solar radius outward to the surface, scientists suspect that churning masses of plasma — giant cells — induce a global circulation pattern, moving plasma from the solar equator toward the poles near the surface, and then back to the equator at greater depth. This circulation generates magnetic fields that cause the 11-year sunspot cycle. Better understanding of this cycle and reliable prediction of associated solar storms would help to protect valuable assets in space and on Earth.

AIDS is caused by the human immunodeficiency virus (HIV), which invades cells of the immune system and eventually breaks down the body’s ability to fend off disease. HIV-1 reverse transcriptase (RT), a multi-functional protein that is part of HIV, essentially copies and pastes HIV’s DNA, which is then incorporated into immune system cells of the infected person.

Interfering with RT’s function would shut down HIV’s reproductive capability, which explains why RT is the target of several FDA-approved anti-AIDS drugs.

“A precise, clear understanding of how RT works could make it possible to design more effective anti-AIDS drugs that could give a knockout punch to this worldwide scourge,” says Madrid. “This work will be important in drug design,” says Madrid, “because it shows details of the motion that have not been observed before by any other computational technique.”