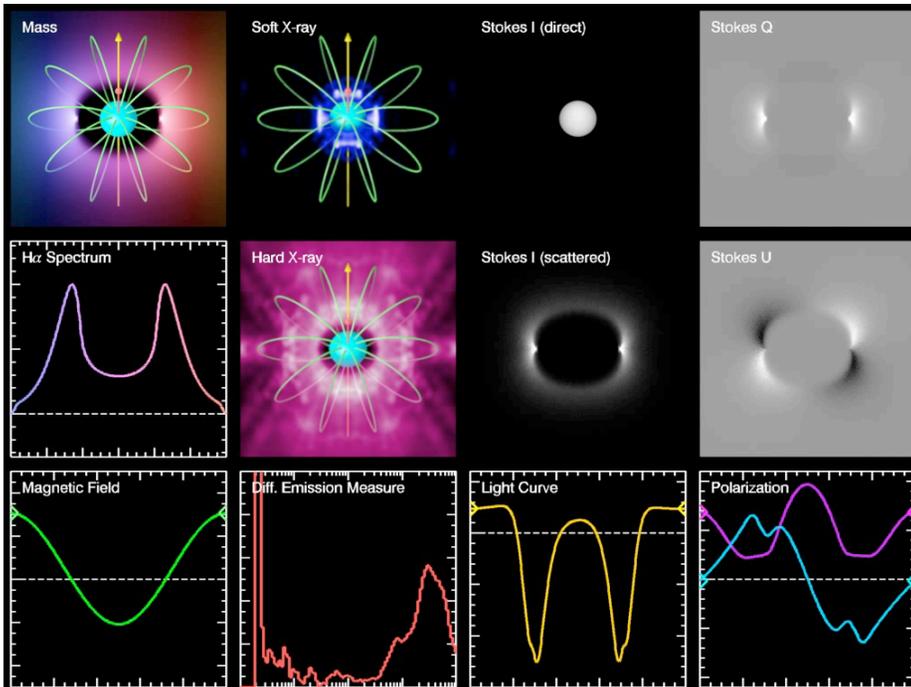
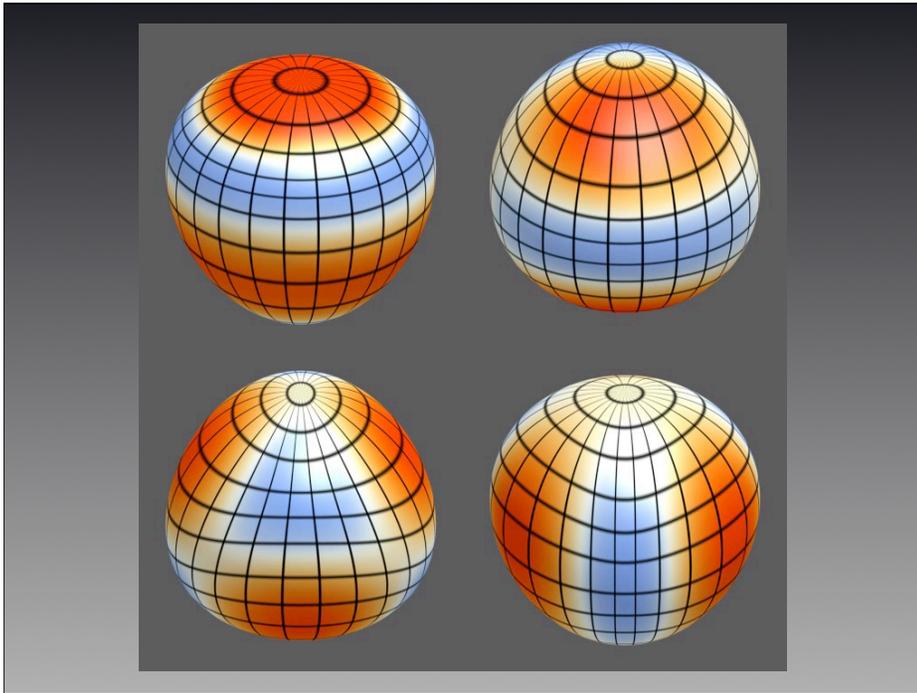


Two faces of massive-star pulsation

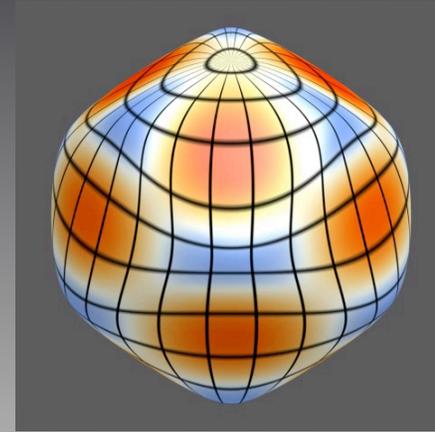
Rich Townsend



Stellar pulsation: the periodic disturbance of a star by wave-like motions

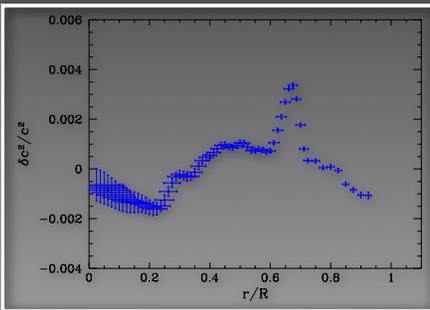


Asteroseismology: probing internal structure by analyzing pulsations



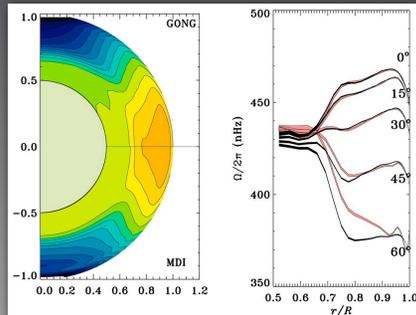
Highlights from helioseismology

Sound-speed squared throughout interior



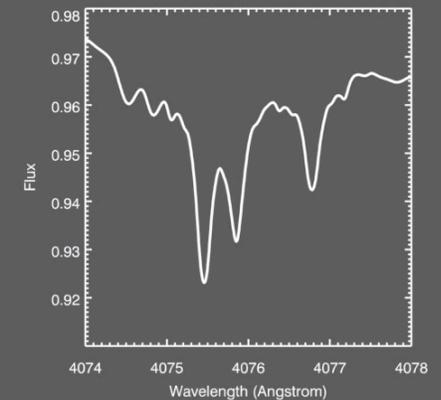
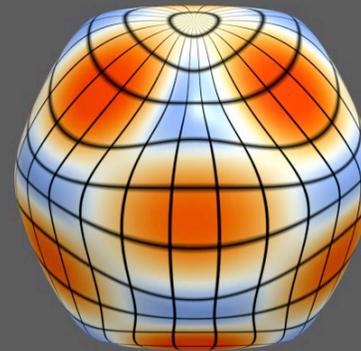
SOHO/MDI

Rotation in outer envelope



GONG & SOHO/MDI

For remote stars, mode identification requires spectroscopic follow-up



BRUCE / KYLIE codes (Townsend)

GRASSY: A Hardware-Accelerated Spectral Synthesis Engine for Asteroseismic Mode Identification

- NSF *Advanced Technology and Instrumentation* program
- 3 years
- With CompSci (co-PI Karu Sankaralingam)
- 2 graduate students
- \$348,681 (\$15,000 equipment)

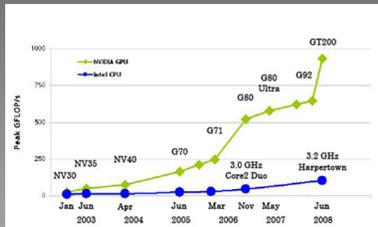
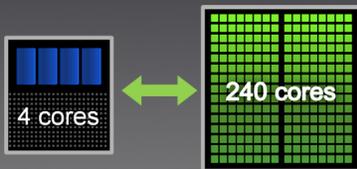


Mirror's Edge (DICE)



NVIDIA GeForce 7960 GT

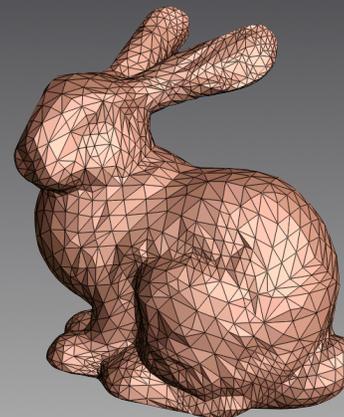
General-Purpose Computing on GPUs (GPGPU)



- Exploit parallel processing capability of GPUs
- Example applications:
 - Engineering (fluid dynamics, FFT)
 - Finance (pricing, market sims)
 - Cryptography (hashing, encryption)
 - Astronomy (data processing, N-body sims)
- Dedicated GPGPU platforms are available from a number of vendors

see <http://ggpu.org/>

GPUs excel at table-based lookups ('texturing')



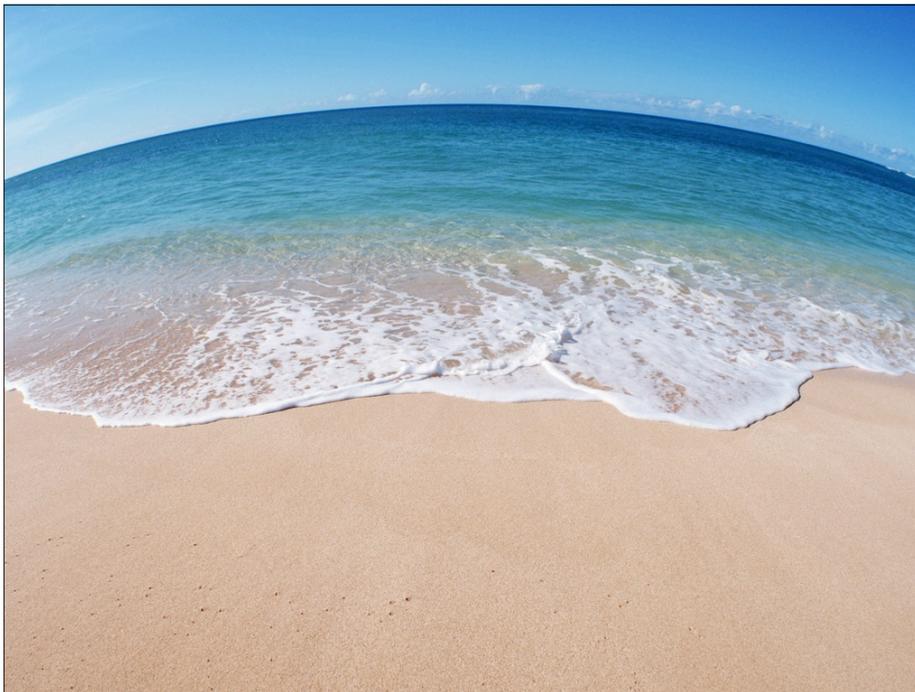
GRASSY: Status

- Design & purchasing phase
- Likely platform: 8 x NVIDIA C1060 units (~8 Teraflops)
- Projected performance:
 - 3ms / spectrum / GPU
 - 2700 spectra / s
 - Speed up x 1,000
- Timeline:
 - Prototype by Spring 2010
 - Integrated platform by Spring 2011



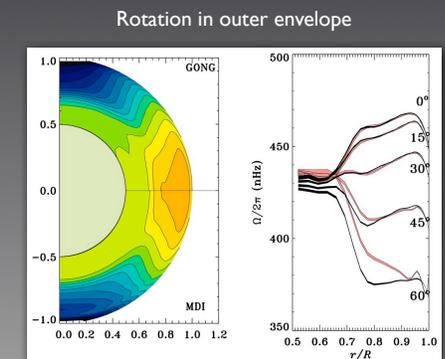
From narrator...

...to protagonist



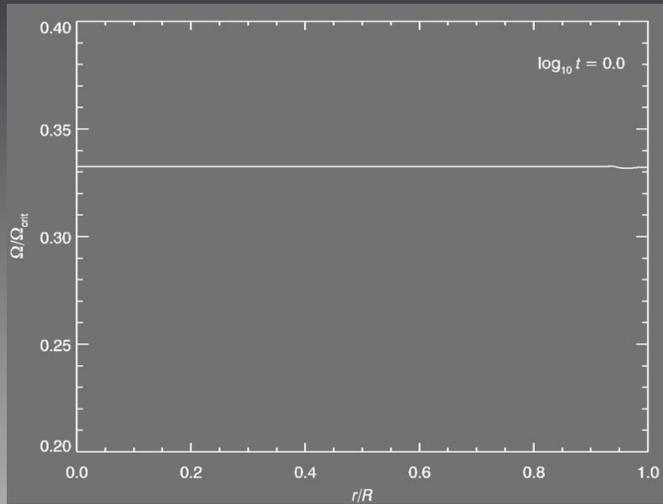
Angular momentum transport by waves in the Sun

- Helioseismology reveals a uniformly-rotating interior in the Sun
- Pulsation waves proposed as a mechanism for extracting angular momentum from the interior
- Can this occur in massive stars?



GONG & SOHO/MDI

Wave transport in a $5 M_{\odot}$ model



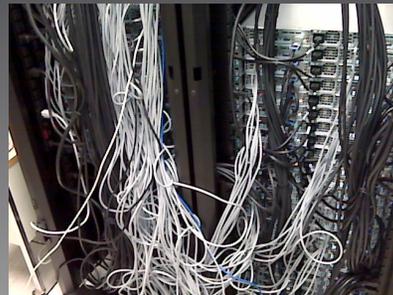
HEIMDALL CODE (Townsend)

Wave Transport of Angular Momentum: A New Spin on Massive-Star Evolution

- NSF *Astronomy & Astrophysics Research* program
- 3 years
- 1 postdoc, 1 grad student
- \$428,021

Wave Transport: Status

- Initial work favorably received at Santa Fe meeting
- Recently purchased Medusa supercomputer (w/ theory group)
- Currently working on new technique for modeling pulsation on parallel architectures (pencil & paper); v.excited!
- Personnel:
 - Nick Hill (1st-year grad student)
 - Advertising for postdoc



Infiniband cabling at the back of Medusa

Summary

- Goals for year 1:
 - Teach ✓
 - Write proposals ✓
 - Don't get frostbite ✓
- Goals for year 2:
 - Enjoy teaching ✓
 - Do science