Single Timestep in Rayleigh

A) **Spectral Space**

r local / in-processor
l, m distributed

1) Time-stepping
2) Linear solve
3) Radial derivatives

Transpose

B) **Hybrid Space**

l local / in-processor
r, m distributed

1) θ derivatives $\sin\theta\frac{\partial F}{\partial\theta}$

2) Legendre Transforms

Transpose

C) **Physical Space**

m local / in-processor
r, l distributed

1) φ derivatives
2) Fourier Transforms
3) Nonlinear Terms
4) Diagnostics

Transpose

D) **Hybrid Space**

l local / in-processor
r, m distributed

1) θ derivatives $\frac{1}{\sin\theta}\frac{\partial\sin^2\theta F}{\partial\theta}$

2) Legendre Transforms

Transpose

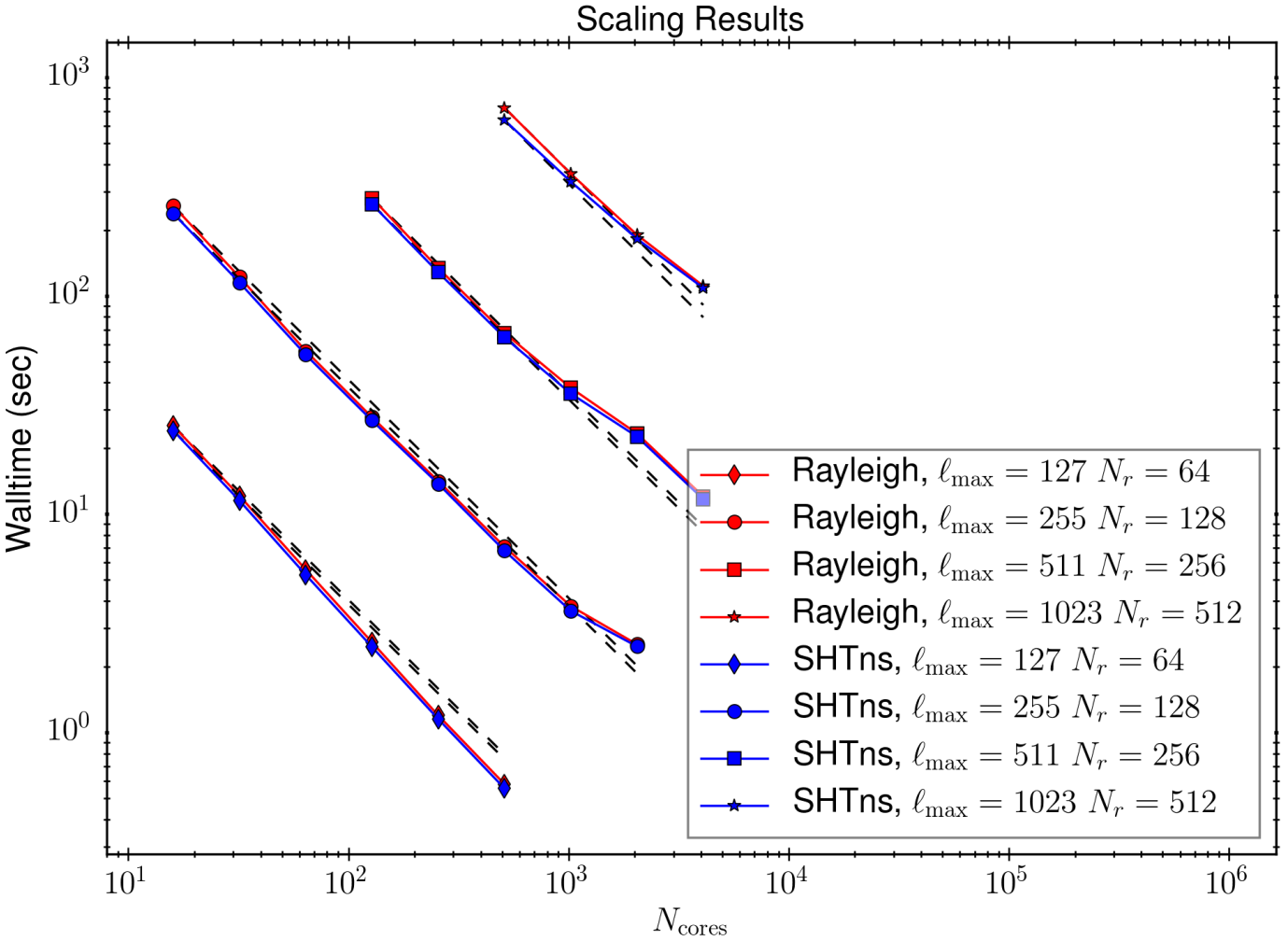
FFT = fast ~ O(N log N)

LT = slow ~ O(N^2)

Spherical Harmonic Transform Library: SHTns

- Written in C/C++, fast compared to other SHT libraries
- Exploit symmetries and optimizes near poles
- Choice of recursion algorithm
- On-the-fly option to compute polynomials
- Included support for SHTns into Rayleigh

Performance of Rayleigh + SHTns



- SHTns includes support for OpenMP
- Next step: update OMP in Rayleigh