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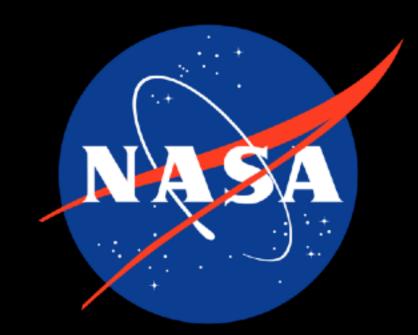
5. GRID-BASED NUMERICAL METHODS
…… WITH MESH REFINEMENT / PATCHES

- Do all that stuff from earlier…..

- Now the grid is made out of components and/or patches with different resolutions, needs a data structure to define it

- Need an algorithm to generate and update the adaptive mesh

- High resolution regions that overlap with low-resolution regions need to control over grid variables on the low-resolution by *restricting* their values to match the (possibly interpolated) high resolution grid values ("**restriction**")

- Low resolution regions need to supply extra grid points to the ghost-zones of their higher-resolution neighbors that don't exist in the low-resolution grid by interpolating the additional points ("**prolongation**")

- Time-steps no longer match between low and high resolution meshes, care must be taken to keep track of time levels, and potentially add buffer zones, while handling the communication

CACTUS - A MODULAR FRAMEWORK

- Funded partly by NASA's Binary Neutron Star Grand Challenge

- Developed at AEI/Cardiff/LSU, initial release in 1997

- Modular framework to **separate technical infrastructure**
  (all the communication and grid structure stuff, etc.)
  from **science code** *(variable definitions, right hand sides, numerical
  methods)* to ease development of grid-based partial differential
  equation sovlers

- Researchers need only write "thorns" that implement specific
  functionality