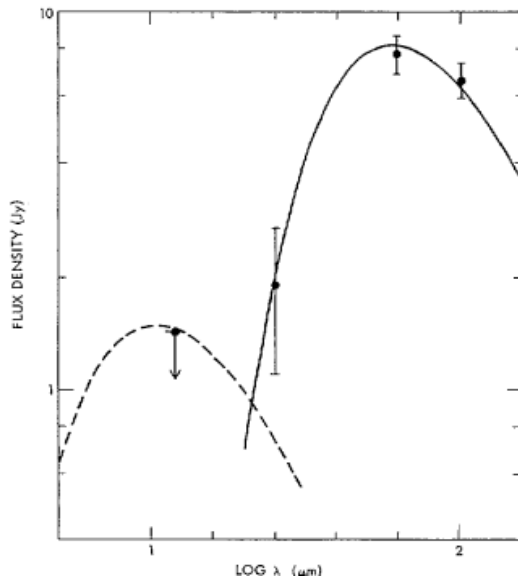


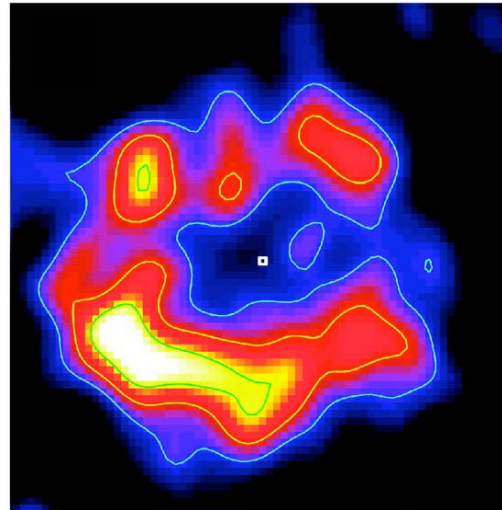
debris disks with CCAT

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1984



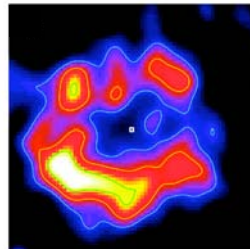
1998

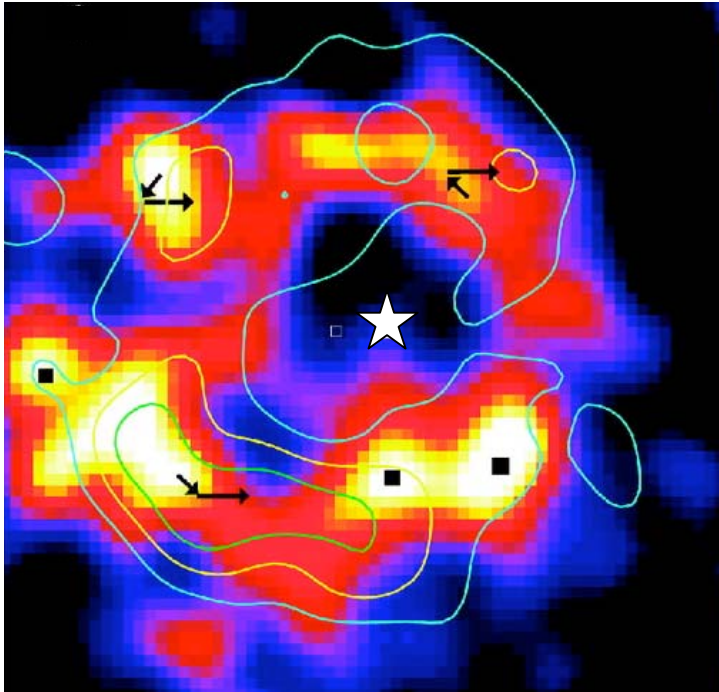


~2012??

why observe debris disks?

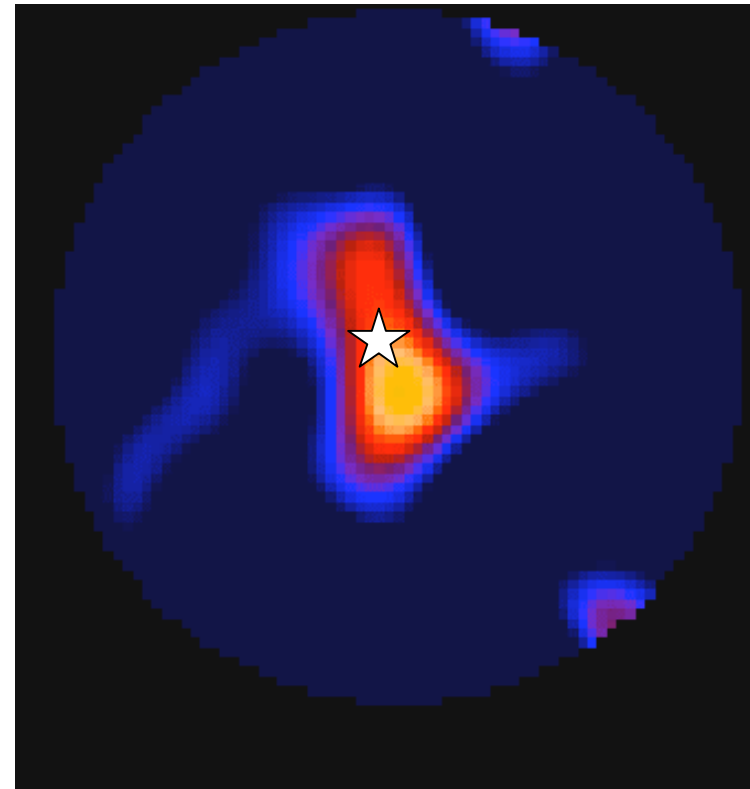
- outcomes of planet formation
 - planets or comets or both?
 - unknown if Solar System configuration is rare or common
- debris = comets = impacts = habitability
- planet detection!
 - via perturbation of debris disks
 - unique for finding distant, low-mass planets





clumps rotate at period
of planet inside ring...

20x level of Kuiper belt dust,
around nearest Sun analogue

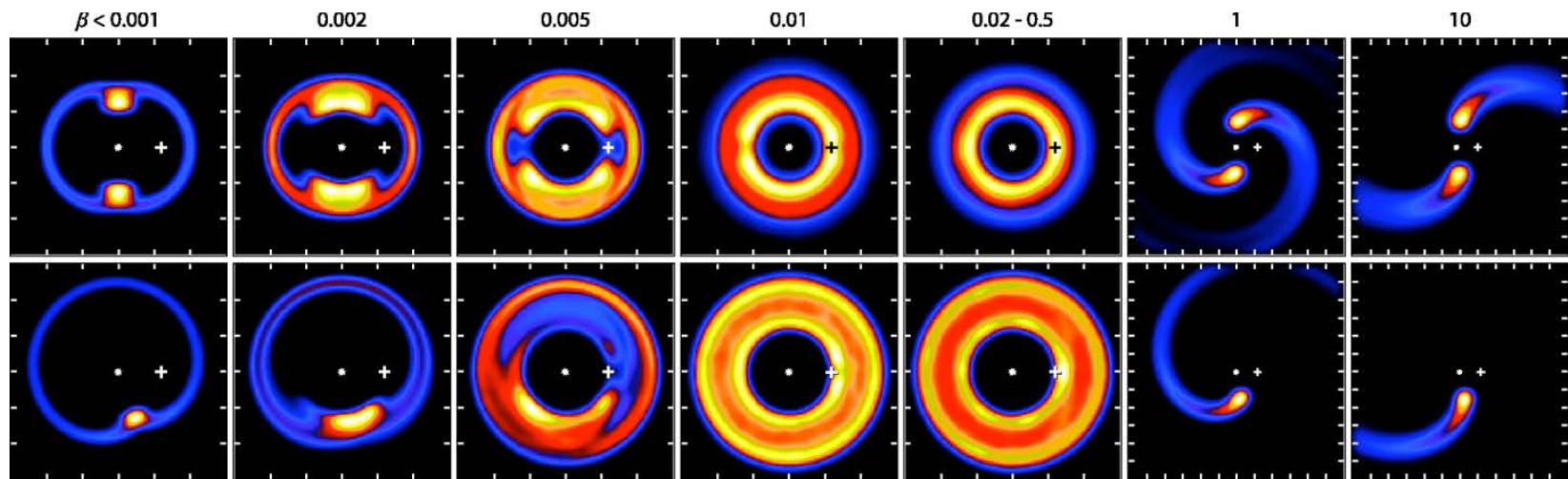
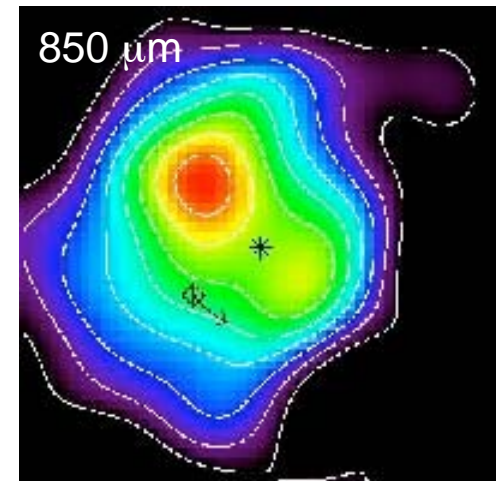
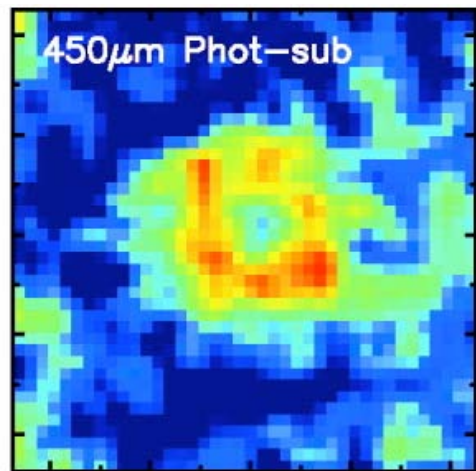
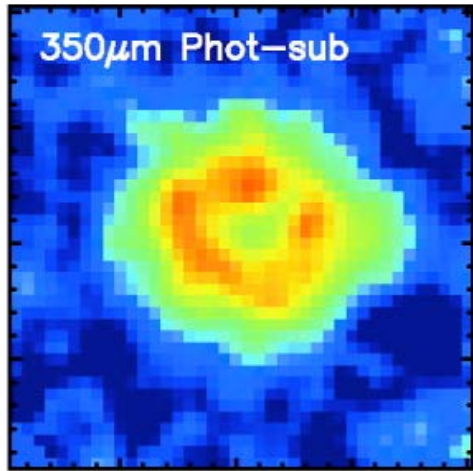


number of systems?

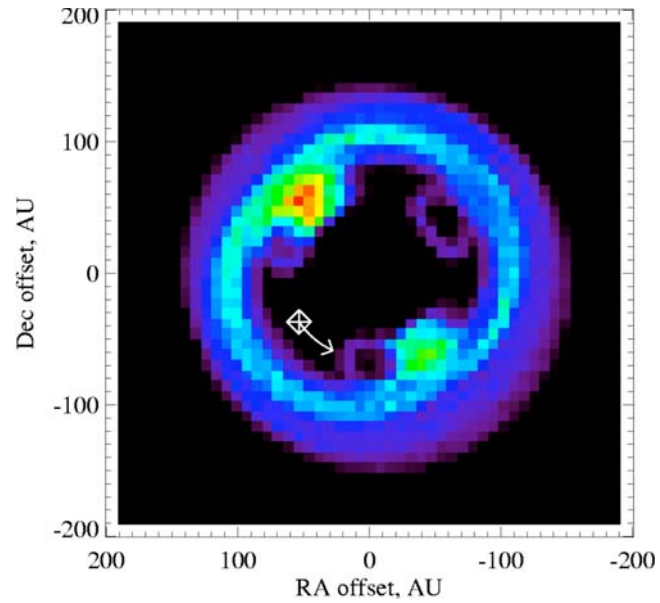
- number resolved with SCUBA was ~7
 - sensitivity *and* resolution problem
 - faint extended lumpy disk has low surface brightness, and infested by background galaxies
- expectation for CCAT?
 - e.g. with 4x resolution, 64x the search volume...
 - hundreds of stars = true picture of disk population
 - distinguish disk shapes from background galaxies
 - including rotation after ~1 year

advantages of CCAT

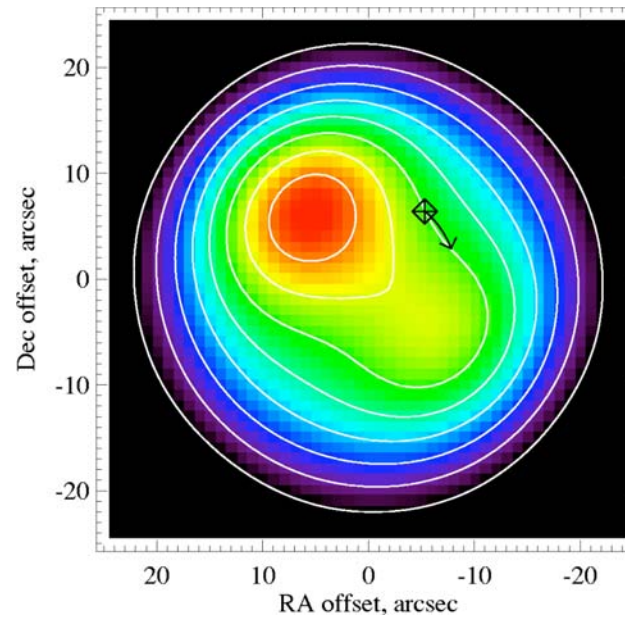
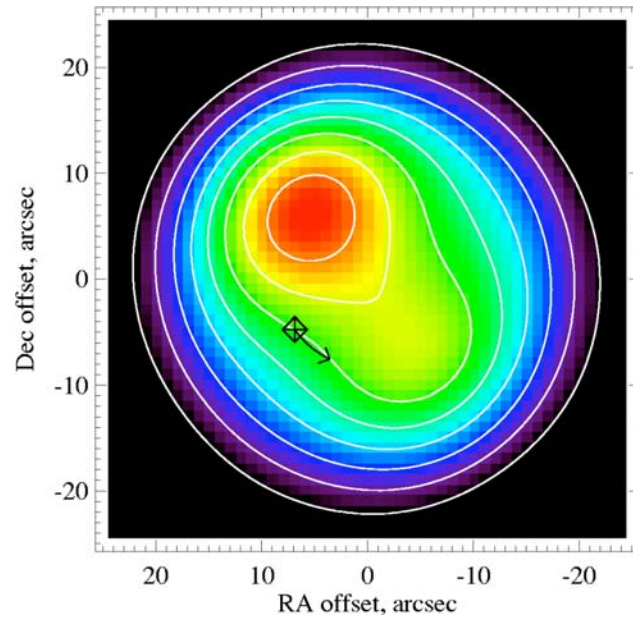
- high resolution and image fidelity
 - measure basics like dust ring size and width
 - map out structure and fraction of dust captured in planetary resonances... > planet properties
- high sensitivity
 - SCUBA-2 would not reach Solar System dust levels even at α Centauri distance... CCAT can
- coverage of short-to-long submm
 - see different structures... > properties of debris (e.g. recent catastrophic collisions?) and of planet



Vega: Holland et al. 1998, Marsh et al. 2006, example models from Wyatt 2006



with higher resolution, can identify particular resonances... hence, details even such as direction of planet's orbit



with CCAT:

- many imageable systems
 - diversity of disk architectures
 - lots of planet candidates
- unique CCAT science?
 - Solar System analogues impossible in the far-IR unless star and disk are resolved
 - would require SAFIR/GISMO-class observatory (10-30 m)
 - distant prospect?



cf. JCMT, Herschel, ALMA

- SCUBA-2 survey will identify dozens of nearby debris disks
- Herschel follow-up will pin down dust temperatures and masses
- ALMA great for details of perturbed structure
- *with CCAT:*
 - full picture of disk sizes, incidence of perturbing planets, frequency of comet collisions etc.