igure 4 of McMullin et al. 1994.

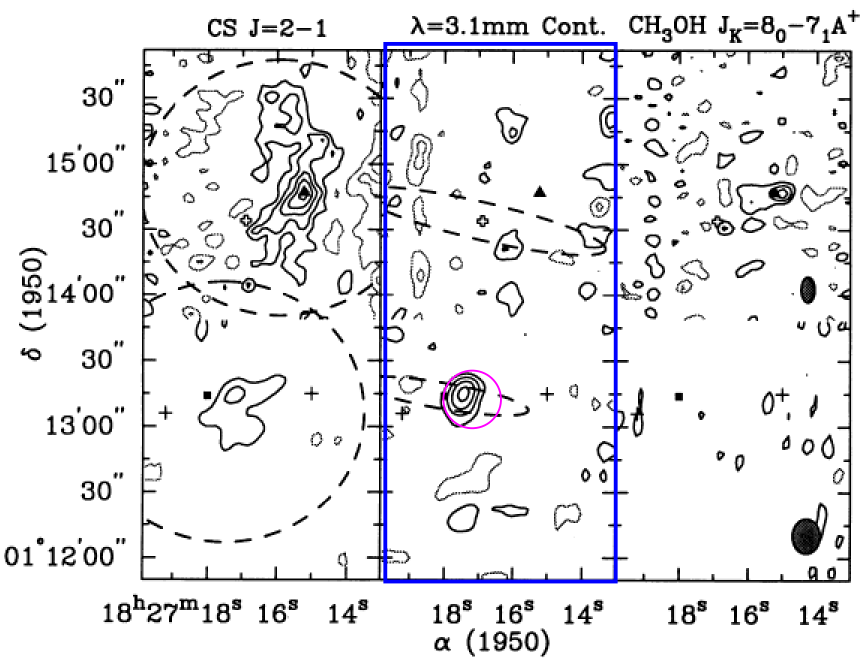


FIG. 4.—Mosaiced integrated intensity maps of S68 FIRS 1 and S68 N. The dashed circles to the left panel denote the size of the primary beam for the nterferometer observations. The dashed curves in the center panel represent the error ellipses for the associated *IRAS* sources. The synthesized beams for ointing center are shown in the right panel. The contour levels for the molecular emission are in steps of 3.6 Jy beam^{-1} km s^{-1} for CS and 3.0 Jy beam^{-1} km s^{-} H$_3$OH. For S68 FIRS 1, the molecular emission was integrated from 7 to 12 km s^{-1}; for S68 N, the emission was integrated from 2 to 16 km s^{-1} for CS and fro 11 km s^{-1} for the CH$_3$OH emission. For the $\lambda = 3$ mm continuum emission, the contours are in steps of 0.03 Jy beam^{-1}. The box marks the position of the *I* ource associated with S68 FIRS 1; the triangle marks the position of S68 N as determined from the CS emission in the left panel. The solid crosses mark the aser positions and the hollow cross marks the position of IRAS 18272 + 0114.

Figure 1 of Testi & Sargent 1998:

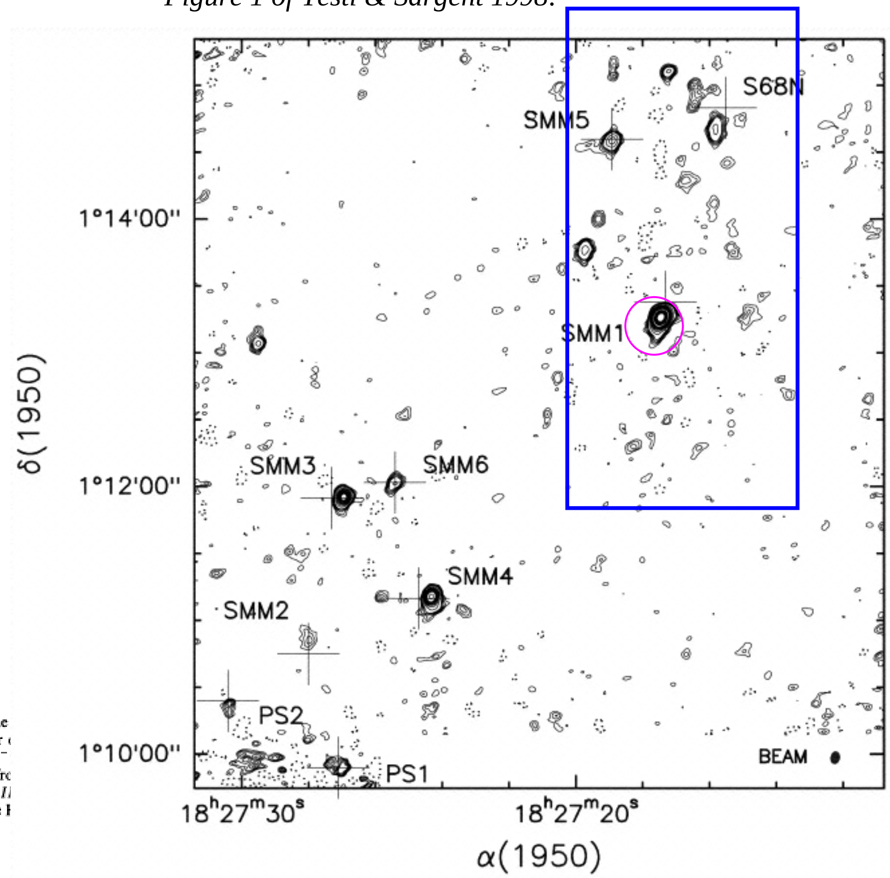


Figure 1: OVRO 3 mm continuum mosaic of the Serpens core. Contour levels are -2.7, 2.76.3 by 0.9, 1042 by 4, and 55105 by 10 mJy beam-1. The positions of the known submillimeter sources (CED) and far-infrared sources (Hurt & Barsony 1996) are marked by crosses. Note that we detect all the sources already identified and have refined the positional accuracy. In addition, numerous new sources can be seen. The synthesized beam, 55?43 (FWHM), is shown as a filled ellipse in the lower right-hand corner.

McMullin et al. 1994	**Testi & Sargent 1998**
• BIMA with (only!) three elements • Eight configurations→coverage of 2 kλ to 30 kλ • Naturally wtd. Beam of 11" x 6" (for continuum obs.) • CLEANed in MIRIAD, rms of 0.014 Jy/beam (continuum) • No correction for primary beam taper, or other fancier corrections	• OVRO, six 10.4 m elements • 50 separate pointings, four configurations→5 kλ to 80 kλ (gives coverage of features down to 30"/0.045 pc/9300 AU) • calibration/editing with MMA then AIPS VTESS for MEM • natural wtg., gaussian taper, SMM1, SMM3 & SMM4 removed & then put back to elimainate sidelobe contamination

Resutls of Testi & Sargent's Study of Serpens:

- Kolmogorov-Smirnov test rules out the –1.7 power law typical of the CMF at 98% confidence level
- Best-fitting power law has slope –2.1, similar to IMF, but authors (correctly) say the data are too sparse to draw definite conclusions, and that this coincidence is just "promising" so far
- Results agree well with Motte et al. (1998) IRAM observations, which also give similar IMF-like slope for smaller masses

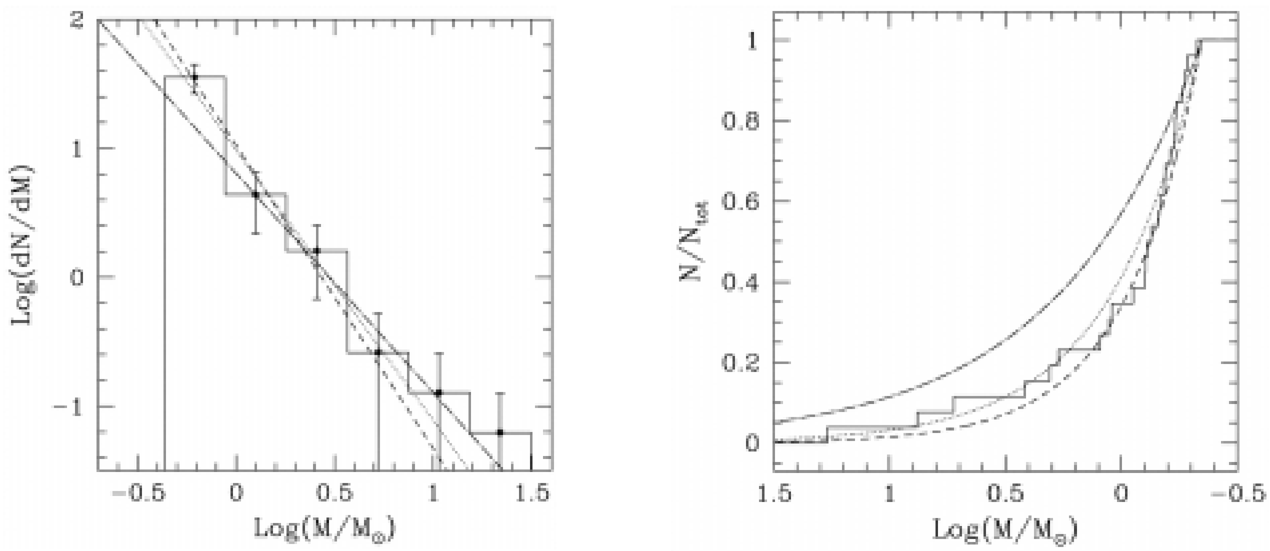


FIG. 3.Left panel: the mass spectrum for the 3 mm continuum sources. The dotted line is the best-fitting power law, $dN/dM \sim M^{-2.1}$; the dashed line represents the Salpeter IMF, $dN/dM \sim M^{-2.35}$; the dot-dashed line is a -1.7 power law. Right panel: the normalized cumulative mass distribution. The dotted, dashed, and dot-dashed lines are the same as in the left panel.

Important assumptions and caveats:

- **Constant** dust temperature **T=15 K**
- Applicability of **"average"** β
- Detection limit of 4.0 mJy/beam translates to 0.4 M_{sun}
- Spherical, isothermal gas cloud with radius 2000 A.U. and T=15 K is bound if M>0.3 M_{sun} , assuming it's supported by thermal pressure, so all the sources **detected** here **assumed to be bound**
- In distribution in Figure 3, YSO-like sources have been removed using near-IR and 12 μm IRAS sources
- Cumulative distribution does not rely on binning, wheras "IMF" like plot does

How the masses are calculated:

- Emission assumed optically thin
- $M_d = \dfrac{S_\nu D^2}{\kappa_\nu B_\nu(T_d)}$; $\kappa_\nu = \kappa_{230\text{ GHz}}(\nu / 230\text{ GHz})^\beta$
- $\kappa_{230\text{ GHz}} = 0.005\text{ cm}^2\text{ g}^{-1}$
- Average value of β=1.1 (from range of 0.7 to 1.6 from SED fits) used for all sources
- *Note:* $\dfrac{(100/230)^{0.7}}{(100/230)^{1.6}} = 2.1$ (not too bad; assumption about constant T_d is worse)

General conclusions of Testi & Sargent:

- Mass function more consistent with IMF than CMF.
- Perhaps these condensations are Myers' "kernels"? Typical distance between discrete sources is ~0.03 to 0.06 pc, typical kernel size.
- Also consistent with recent simulations of Klessen, Burkert & Bate (1998; see next page).

Key figures from Klessen, Burkert & Bate 1998:

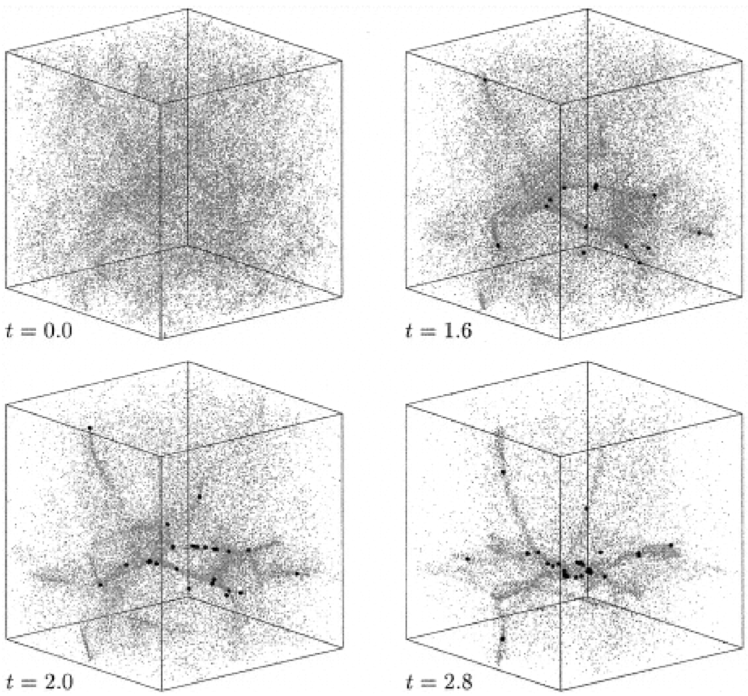


FIG. 1.Time evolution and fragmentation of a region of 222 Jeans masses in the interior of a molecular cloud with initial Gaussian density fluctuations with power law $P(k)\sim 1/k^2$. The collapse sets in and soon forms a cluster of highly condensed cores, which continue to accrete from the surrounding gas reservoir. At t=1.6, about 10% of all the gas mass is converted into "protostellar" cores (black dots). At t=2.0 and t=2.8, these values are 30% and 60%, respectively. The initial number of particles used for the SPH simulation is 500,000. For legibility, only every 10th particle is plotted.

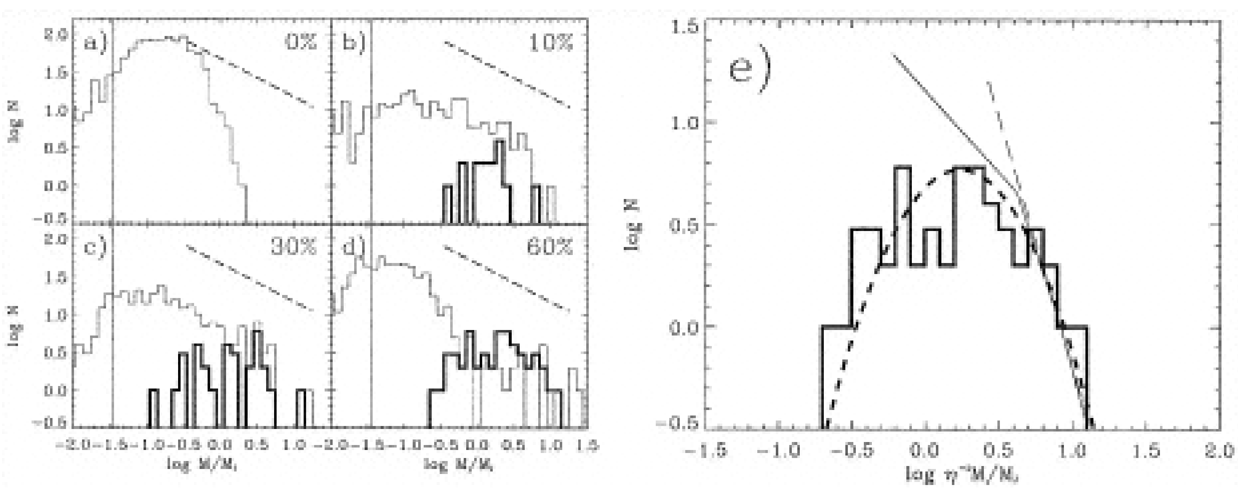


FIG. 3.(a-d) Mass distribution of gas clumps (thin lines) and of protostellar cores (thick lines) at times t=0.0, 0.7, 1.3, and 2.0 when, respectively, 0%, 10%, 30%, and 60% of the total gas mass is condensed in cores. The vertical lines indicate the resolution limit of the simulation with 500,000 particles, and the dashed lines illustrate the observed clump mass spectrum with $dN/dM\sim M^{-1.5}$ (Blitz 1993). (e) Comparison of the final core mass spectrum (thick line) with different observationally based models for the IMF. The thick dashed line denotes the lognormal form for the IMF, uncorrected for binary stars as proposed by Kroupa et al. (1990). In order for the peaks of both distributions to overlap, a core star formation efficiency has to be assumed. The agreement in width is remarkable. The multiple power-law IMF, corrected for binary stars (Kroupa et al. 1993), is shown by the thin solid line. As a reference, the thin dashed line denotes the Salpeter (1955) IMF. Both are scaled to fit at the high-mass end of the spectrum. All masses are scaled to the overall Jeans mass in the system.

Results from Motte et al 1998 (see color handout on separate page):

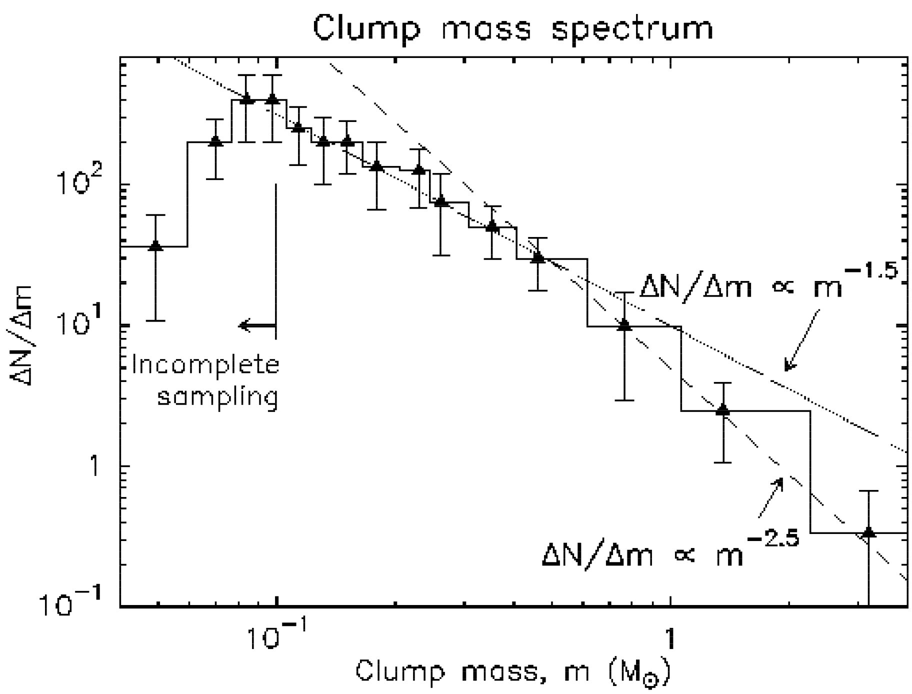
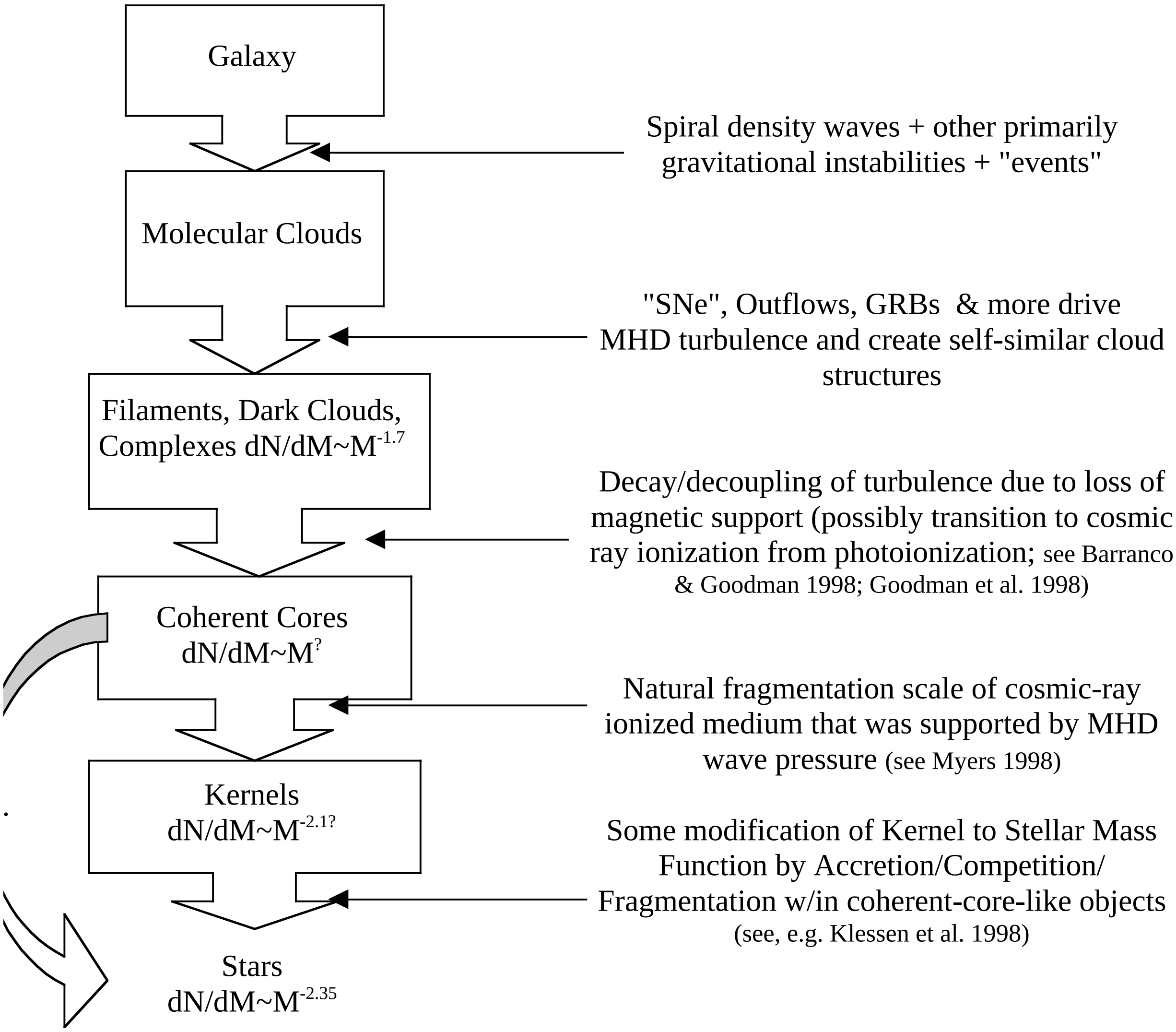


Fig. 5. Frequency distribution of masses for 60 small-scale clumps extracted from the mosaic of Fig. 1 (solid line). The dotted and long-dashed lines show power laws of the form $\Delta N/\Delta m \sim m^{-1.5}$ and form $\Delta N/\Delta m \sim m^{-2.5}$, respectively. The error bars correspond to counting statistics.

AG's current thinking on what breaks the ISM into star-like pieces:



So, ultimately, the $dN/dM \sim M^{-1.7}$ is representative of the mass distribution of gas in the "turbulent" molecular clouds, and $dN/dM \sim M^{-2.1}$ is then characteristic of the fragmentation process that takes place inside coherent core-like objects. Note that the key question raised by this argument is whether the IMF of stars formed "alone" (see "OR" above) in coherent cores that are too small & low-pressure to form clusters is different than the IMF in clusters. Or, perhaps the coherent cores "fragment," too, but only one of the pieces is big enough to form a star??

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