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VLBI OBSERVATIONS OF THE TINTÍN AND MILÚ NEBULAE

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Abstract: And here you write whatever you think is appropriate.

1 Introduction

Thompson et al. [1985] begin like that: "The techniques of radio interferometry as applied to astronomy and astrometry have developed enormously in the past four decades, and the attainable angular resolution has advanced from degrees to milliarcseconds, a range of over six orders of magnitude. As arrays for synthesis mapping have developed, techniques in the radio domain have overtaken those in optics in pfoviding the finest angular detail in astronomical images. The same general developments have introduced new capabilities in astrometry and in the measurement of the earth's polar and crustal motions. The theories and techniques that underlie these advances continue to evolve, but have reached by now a sufficient state of maturity that is appropriate to offer a detailed exposition." Some of the advances mentioned there may be reported in the Proceedings of PERE 2006.

In the next lines, you will find a sample text to answer your questions about the style and format of these proceedings.

In the *nucleated instability* (also called core instability) hypothesis of giant planet formation, a critical mass for static core envelope protoplanets has been found. Mizuno [1980] determined the critical mass of the core to be about $12\,M_\oplus$ ($M_\oplus = 5.975 \times 10^{27}\,\mathrm{g}$ is the Earth mass), which is independent of the outer boundary conditions and therefore independent of the location in the solar nebula. This critical value for the core mass corresponds closely to the cores of today's giant planets.

Although no hydrodynamical study has been available many workers conjectured that a collapse or rapid contraction will ensue after accumulating the

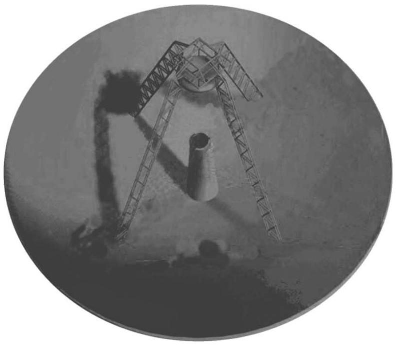

Figure 1: This is a really big radiotelescope.

critical mass. The main motivation for this article is to investigate the stability of the static envelope at the critical mass. With this aim the local, linear stability of static radiative gas spheres is investigated on the basis of Baker's [1966] standard one-zone model. Phenomena similar to the ones described above for giant planet formation have been found in hydrodynamical models concerning star formation where protostellar cores explode (Tscharnuter [1987], Balluch [1988]), whereas earlier studies found quasi-steady collapse flows. The similarities in the (micro)physics, i.e., constitutive relations of protostellar cores and protogiant planets serve as a further motivation for this study.

Telescope	Diam. (m)	Country
Arecibo	305	Puerto Rico
Green Bank	110	USA
Effelsberg	100	Germany
Lovell	76	England
Robledo	70	Spain
Goldstone	70	USA
Medicina	32	Italy

Table 1: A few examples of big radiotelescopes.

2 Baker's standard one-zone model

In this section the one-zone model of Baker [1966], originally used to study the Cepheïd pulsation mechanism, will be briefly reviewed. The resulting stability criteria will be rewritten in terms of local state variables, local timescales and constitutive relations. Baker [1966] investigates the stability of thin layers in

self-gravitating, spherical gas clouds with the following properties:
• hydrostatic equilibrium,
• thermal equilibrium,
• energy transport by grey radiation diffusion.
For the one-zone-model Baker obtains necessary conditions for dynamical, secular and vibrational (or pulsational) stability (Eqs. (34a, b, c) in Baker [1966]). Using Baker's notation:

M_r	mass internal to the radius r
m	mass of the zone
r_0	unperturbed zone radius
ρ_0	unperturbed density in the zone
T_0	unperturbed temperature in the zone
L_{r0}	unperturbed luminosity
$E_{\rm th}$	thermal energy of the zone

and with the definitions of the *local cooling time*

$$\tau_{\rm co} = \frac{E_{\rm th}}{L_{r0}} \,, \tag{1}$$

and the *local free-fall time*

$$\tau_{\rm ff} = \sqrt{\frac{3\pi}{32G}\frac{4\pi r_0^3}{3M_{\rm r}}} \,, \tag{2}$$

Baker's K and σ_0 have the following form:

$$\sigma_0 = \frac{\pi}{\sqrt{8}}\frac{1}{\tau_{\rm ff}} \tag{3}$$

$$K = \frac{\sqrt{32}}{\pi}\frac{1}{\delta}\frac{\tau_{\rm ff}}{\tau_{\rm co}} \,; \tag{4}$$

where $E_{\rm th} \approx m(P_0/\rho_0)$ has been used and

$$\begin{array}{l} \delta = -\left(\frac{\partial \ln \rho}{\partial \ln T}\right)_P \\ e = mc^2 \end{array} \tag{5}$$

is a thermodynamical quantity which is of order 1 and equal to 1 for non-reacting mixtures of classical perfect gases. The physical meaning of σ_0 and K is clearly visible in the equations above. σ_0 represents a frequency of the order one per free-fall time. K is proportional to the ratio of the free-fall time and the cooling time. Substituting into Baker's criteria, using thermodynamic identities and definitions of thermodynamic quantities,

$$\Gamma_1 = \left(\frac{\partial \ln P}{\partial \ln \rho}\right)_S , \; \chi_\rho = \left(\frac{\partial \ln P}{\partial \ln \rho}\right)_T , \; \kappa_P = \left(\frac{\partial \ln \kappa}{\partial \ln P}\right)_T$$

$$\nabla_{\rm ad} = \left(\frac{\partial \ln T}{\partial \ln P}\right)_S , \; \chi_T = \left(\frac{\partial \ln P}{\partial \ln T}\right)_\rho , \; \kappa_T = \left(\frac{\partial \ln \kappa}{\partial \ln T}\right)_T$$

one obtains, after some pages of algebra, the conditions for *stability* given below:

$$\frac{\pi^2}{8}\frac{1}{\tau_{\rm ff}^2}(3\Gamma_1 - 4) \;>\; 0 \tag{6}$$

$$\frac{\pi^2}{\tau_{\rm co}\tau_{\rm ff}^2}\Gamma_1\nabla_{\rm ad}\left[\frac{1-3/4\chi_\rho}{\chi_T}(\kappa_T - 4) + \kappa_P + 1\right] \;>\; 0 \tag{7}$$

$$\frac{\pi^2}{4}\frac{3}{\tau_{\rm co}\tau_{\rm ff}^2}\Gamma_1^2\,\nabla_{\rm ad}\left[4\nabla_{\rm ad} - (\nabla_{\rm ad}\kappa_T + \kappa_P) - \frac{4}{3\Gamma_1}\right] \;>\; 0 \tag{8}$$

For a physical discussion of the stability criteria see Baker [1966] or Cox [1980].

We observe that these criteria for dynamical, secular and vibrational stability, respectively, can be factorized into
1. a factor containing local timescales only,
2. a factor containing only constitutive relations and their derivatives.
The first factors, depending on only timescales, are positive by definition. The signs of the left hand sides of the inequalities (6), (7) and (8) therefore depend exclusively on the second factors containing the constitutive relations. Since they depend only on state variables, the stability criteria themselves are *functions of the thermodynamic state in the local zone.* The one-zone stability can therefore be determined from a simple equation of state, given for example, as a function of density and temperature.

3 Conclusions

Everything has a beginning and an end. That is the end of this sample paper. Have fun by writing your one!

Acknowledgements: Here come, as it is obvious, the acknowledgements.

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