

Francesco's Legacy

Star Formation in Space and Time

A French-Italian decade in Francesco's life: 1992-2002

- *PMS evolution*
 - *intermediate-mass stars*
- *birthline, formation of clusters*
- *star formation in galaxies*
- *primordial stars and chemistry*
- *etc., etc., etc.*
- *and lots of fun filled with enthusiasm !!!*

CLASSICAL P.M.S. THEORY

WHEN DOES THE HYDROSTATIC
CONTRACTION PHASE BEGIN?

Hayashi, Cameron ('60) → THE PRECEDING
PROTOSTELLAR DYNAMICAL COLLAPSE PHASE
IS IRRELEVANT FOR ESTABLISHING THE I.C.
OF A P.M.S. STAR -

∴ t_{eff} very short → \dot{E} small →
grav pot en. → thermal en + ionisation
cloud star

∴ virial theorem

$$R_{\text{P.M.S.}}^{\text{init}} = 50 R_0 \left(\frac{M_{\text{P}}}{M_0} \right)$$

(Cameron 1963)

∴ if $R_{\text{P.M.S.}} = R_{\text{P.M.S.}}^{\text{init}}$ → star is fully convective
(Guttenheimer 1966, Van den Briel 1966)

No PowerPoint !

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Antonella
Natta

FP

Jean-Pierre
Chièze† (2015)

Isle of Yeu – Ile d'Yeu, Vendée (Atlantic Ocean), France, Sep. 1992 (15 part.)



Isle of Yeu – Ile d'Yeu, Vendée (Atlantic Ocean), France, Sep. 1992



Malcolm
Walmsley† (2017)

Antonella
Natta

Ponza Island – Isola di Ponza (Mediterranean Sea, near Naples), Italy, May 1999
~40 part. (with spouses !)



Aug.11, 1999: Total solar eclipse near Reims (Champagne, France)



After the eclipse, in the Pommery vineyards !



(Relief)
Fortunately, the Sun came back !



Les Arcs (Rencontres de Moriond)
Feb. 2002



STAR FORMATION IN SPACE AND TIME: TAURUS-AURIGA

FRANCESCO PALLA¹ AND STEVEN W. STAHLER²

Received 2002 April 10; accepted 2002 August 21



ABSTRACT

To understand the formation of stellar groups, one must first document carefully the birth pattern within real clusters and associations. In this study of Taurus-Auriga, we combine pre-main-sequence ages from our own evolutionary tracks with stellar positions from observational surveys. Aided by the extensive millimeter data on the molecular clouds, we develop a picture of the region's history. Star formation began, at a relatively low level and in a spatially diffuse manner, at least 10^7 yr in the past. Within the last few million years, new stars have been produced at an accelerating rate, almost exclusively within a confined group of striated cloud filaments. The gas both inside and around the filaments appears to be in force balance. Thus, the appearance of the filaments is due to global, quasi-static contraction of the parent cloud material. Gravity drives this contraction and shock dissipation mediates it, but the internal motion of the gas does not appear to be turbulent. The accelerating nature of recent star formation means that the condensation of cloud cores is a threshold phenomenon, requiring a minimum background density. Other, nearby cloud regions, including Lupus and Chamaeleon, contain some locales that have attained this density, and others that have not. In the latter, we find extensive and sometimes massive molecular gas that is still devoid of young stars.

Subject headings: ISM: clouds — ISM: individual (Taurus-Auriga) — ISM: kinematics and dynamics — open clusters and associations: general — stars: formation — stars: pre-main-sequence