

MEMORIE DELLA SOCIETÀ ASTRONOMICA ITALIANA

Vol.88 n.4 2017

**Francesco's legacy: star formation in space and time**

*Firenze, June 5–9, 2017*

*editors:* R. Cesaroni, E. Corbelli and D. Galli

**TABLE OF CONTENTS**

<i>Index</i>	475
<i>Foreword</i>	484
<i>List of Participants</i>	488
<i>Conference pictures</i>	497
S. Stahler <i>A long friendship</i>	503
G. Melnick and T. Montmerle <i>Francesco's memories</i>	506
P. Boncinelli and L. Casetti <i>Francesco's legacy in education and outreach</i>	509
<b>The Evolution of Molecular Clouds</b>	
P. Hennebelle <i>Molecular cloud formation, turbulence and feedback</i>	513
Ph., André, V. Könyves, D. Arzoumanian and A. Roy <i>Molecular filaments and the origin of the IMF</i>	521
S. Basu and S. Audu <i>From molecular clouds to the IMF: spatial and temporal effects</i>	524
J. Braine <i>Properties, rotation of molecular clouds in M 33</i>	530
A. Burkert <i>A bathtub model for the star-forming interstellar medium</i>	533
P. Caselli <i>Our astrochemical heritage</i>	536

476		
E. Corbelli The lifecycle of molecular clouds and the extragalactic side of <i>Francesco</i>	544	
C. L. Dobbs Comparing the evolution of clouds and clusters in spiral galaxies	547	
F. Fontani, B. Commerçon, A. Giannetti, M.T. Beltrán, A. Sánchez-Monge and L. Testi <i>Fragmentation of massive dense cores: the role of the magnetic field</i>	551	
S. Inutsuka An origin of accelerating star formation	554	
P. M. Koch, Y.-W. Tang, N.L. Chapman, A. Duarte-Cabral, P. T. P. Ho, G. Novak, N. Peretto, Y.-N. Su, S. Takakuwa and H.-W. Yen <i>Magnetic fields from filaments to cores</i>	557	
K. M. Menten <i>Francesco and masers</i>	560	
S.E. Ragan The role of spiral arms in Milky Way star formation	565	
V. M. Rivilla The formation of prebiotic molecules in star-forming regions	568	
K. Tomisaka <i>Magnetohydrostatic structures of magnetically-supported filaments and their stability</i>	571	
<b>Protostellar and Pre-Main Sequence Evolution</b>		
F. D'Antona <i>From protostellar to pre-main-sequence evolution</i>	574	
M. T. Beltrán and W. J. de Wit" <i>Accretion disks in luminous young stellar objects</i>	581	
H. Beuther, A. Ahmadi, J. Mottram, F. Bosco, H. Linz, P. Klaassen and the CORE team" <i>CORE: fragmentation and disk formation in high-mass star formation</i>	584	
J. Bouvier <i>The early evolution of solar-type stars: accretion, magnetism, and star-disk interaction</i>	587	
S. Lizano and C. Tapia <i>Structure and emission of magnetized accretion disks</i>	593	
M. Marconi and V. Ripepi <i>Pulsation in Herbig stars: an idea of <i>Francesco</i> and its realization</i>	597	
S. T. Megeath <i>Protostars in time and space: results from the Herschel Orion protostar survey</i>	602	

R. D. Oudmaijer, K. M. Ababakr and J. R. Fairlamb <i>The formation and evolution of Herbig Ae/Be stars</i>	605
M. Padovani, A. Marcowith, P. Hennebelle and K. Ferrière <i>Protostars as cosmic-ray factories</i>	608
B. Reipurth <i>Dynamical evolution of young binaries and multiple systems</i>	611
S. Stahler <i>EXors and the stellar birthline</i>	616
M. Tafalla <i>The jet-outflow connection: new results from ALMA</i>	619
E. Tognelli, P. G. Prada Moroni and S. Degl'Innocenti <i>Planet ingestion on a pre-MS star</i>	624
E. I. Vorobyov , V. Elbakyan , T. Hosokawa , Y. Sakurai, M. Guedel and H. Yorke <i>Pre-main-sequence evolution of low-mass stars and brown dwarfs with accretion</i>	627
<b>Young Stellar Clusters</b>	
L. A. Hillenbrand <i>Infant stars behave like teenagers</i>	630
R. D. Jeffries <i>Ages and age spreads in young stellar clusters</i>	637
R. I. Klein <i>Multi-physics, multi-scale simulations of star formation: from large scale (1 kpc) turbulent magnetized Galactic disk to stellar clusters</i>	642
M. Messa and the LEGUS team <i>Dissecting the star cluster population in M51 The LEGUS view</i>	645
S. F. Portegies Zwart and F. Concha-Ramírez <i>The size-evolution of circumstellar disks in the Trapezium cluster</i>	648
T. Prusti <i>Gaia view on young stellar clusters</i>	656
G. G. Sacco, S. Randich, L. Bravi, R. Jeffries and E. Rigliaco <i>Kinematics of young star clusters with the Gaia-ESO Survey</i>	660
L. Spina <i>The metal content of pre-main sequence clusters</i>	663
E. Zari and A. G. A. Brown <i>Mapping young stellar populations towards Orion with Gaia DR1</i>	668

## The First Stars

V. Bromm <i>The first stars: our evolving theoretical picture</i>	671
D. Galli <i>My chemistry with Francesco</i>	678
S. C. O. Glover <i>The dynamics of ionization and dissociation fronts in extremely dense primordial gas</i>	682
D. Hollenbach <i>The effect of photoevaporation on the first stars</i>	685
T. Hosokawa <i>Formation of massive primordial stars controlled by the protostellar evolution</i>	689
P. Molaro <i>The most metal poor stars</i>	692
K. Omukai <i>Francesco's legacy in primordial star formation studies</i>	697
A. T. P. Schauer, S. C. O. Glover and R. S. Klessen <i>The impact of streaming velocities: delaying the formation of the first stars</i>	702
D. R. G. Schleicher, S. Bovino, B. Körtgen, T. Grassi and R. Banerjee <i>Astrochemistry: from primordial gas to present-day clouds</i>	705
R. Schneider <i>Bridging the near and the far: constraints on first star formation from stellar archaeology</i>	708

## Concluding Remarks

H. Zinnecker <i>My friend Francesco Palla</i>	713
--	-----

## POSTER SESSION

### The Evolution of Molecular Clouds

J. Abreu-Vicente <i>Combining Planck and Herschel to improve our view of the Milky Way</i>	718
D. Arzoumanian, Y. Shimajiri, A. Roy, Ph. André, V. Könyves and A. Bracco <i>Observed properties of a filament system in the Orion B molecular cloud</i>	720
M. Benedettini, S. Molinari, A. Baldeschi, M. T. Beltran, J. Brand, R. Cesaroni, D. Elia, F. Fontani, M. Merello, L. Olmi, S. Pezzuto, K. L. J. Rygl, E. Schisano, L. Testi and A. Traficante <i>The Forgotten Quadrant Survey</i>	722

A. Chacón-Tanarro, P. Caselli, L. Bizzocchi, J. E. Pineda, S. Spezzano, B. M. Giuliano, V. Lattanzi and A. Punanova <i>Deuterated methanol map towards L1544</i>	724
R.-A. Chira, J. Kainulainen, J. C. Ibáñez-Mejía, Th. Henning and M.-M. Mac Low <i>Fragmenting filaments in simulations</i>	726
L. Colzi, F. Fontani, V. M. Rivilla, A. Sánchez-Monge, L. Testi, M. Beltrán and P. Caselli <i>Nitrogen fractionation in high-mass star forming cores and its Galactic trend</i>	728
Y. Contreras and P. Sanhueza <i>Initial gas structure in a cold, massive clump: cluster formation in its earliest stages</i>	731
P. Di Cintio, S. Gupta and L. Casetti <i>Non-thermal states in models of filaments: a dynamical study</i>	733
A. Giannetti, S. Leurini, F. Wyrowski, J. Urquhart, C. König, T. Csengeri, R. Güsten and K. M. Menten <i>Evolution of high-mass star-forming regions</i>	735
B. Hasenberger, M. Lombardi, J. Alves, J. Forbrich, A. Hacar and C. J. Lada <i>Towards a physically motivated core definition: the Pipe Nebula as seen in Herschel-Planck emission and NIR extinction</i>	737
S. A. Khoperskov, E. O. Vasiliev and S. S. Khrapov <i>GMCs in galactic scale simulations</i>	739
M. I. N. Kobayashi, S. Inutsuka, H. Kobayashi and K. Hasegawa <i>Time evolution of giant molecular cloud mass functions with cloud-cloud collisions and gas resurrection in various environments</i>	741
A. López-Sepulcre, F. Fontani, R. Neri, C. Favre, C. Ceccarelli, P. Caselli and the SOLIS team <i>OMC-2FIR4: a laboratory to study the formation environment of the Solar System</i>	743
S. Ohashi, P. Sanhueza, T. Hirota, M. Choi, Q. Nguyêñ-Lu'o'ng and K. Tatematsu <i>Multiple star formation of a starless core in the Orion A cloud</i>	745
P. Palmeirim, A. Zavagno, D. Elia and the VIALACTEA team <i>Star formation and ionized regions throughout the inner Galactic plane</i>	747
J. Schober, D. R. G. Schleicher and R. S. Klessen <i>Tracing star formation with radio emission</i>	749
C. Toci and D. Galli <i>Polytropic models of filamentary molecular clouds: structure, stability and magnetic fields</i>	751
R. G. Tress, M. C. Sormani, R. S. Klessen and S. C. O. Glover <i>A simple way to convert sink particles into stars</i>	753

K. Uehara, M. Tsuboi, Y. Kitamura, R. Miyawaki and A. Miyazaki <i>ALMA view of the massive dense clump in the Galactic center 50 km s<sup>-1</sup> molecular cloud</i>	755
Y. Wang, H. Beuther, S. Bühr, M. Rugel, K. G. Johnston and the THOR team <i>The Galactic ionized gas seen with THOR</i>	757
<b>Protostellar and Pre-Main Sequence Evolution</b>	
P. Abrahám, J. Varga, K. 'E. Gabányi, L. Chen, A. Kóspál, Th. Ratzka, R. van Boekel, L. Mosoni and Th. Henning <i>Mid-infrared interferometric variability of DGTau: implications for the inner-disk structure</i>	759
C. Agurto-Gangas, J. E. Pineda, L. Testi, P. Caselli, L. Szűcs, M. Tazzari, M. Dunham, I. W. Stephens and A. Miotello <i>Grain growth in Class I protostar Per-emb-50: a dust continuum analysis with NOEMA &amp; SMA</i>	761
A. Ahmadi, H. Beuther, J.C. Mottram, F. Bosco and the CORE Team <i>Disk properties in high-mass star formation</i>	763
R. M. G. de Albuquerque, V. Cayatte, J. F. Gameiro, J. J. G. Lima and C. Sauty <i>Unveiling YSO dynamics through observations and simulations</i>	765
F. Bacciotti, U. Locatelli, M. Volpi, R.I. Páez, and L. Podio <i>Exploring the feedback of asymmetric jets on the orbital motions in protoplanetary disks</i>	767
E. Bianchi, C. Codella, C. Ceccarelli, F. Fontani, L. Testi, R. Bachiller, B. Lefloch, L. Podio and V. Taquet <i>How organics deuteration changes during the formation of a Sun-like star</i>	769
E. Cahill, E. T. Whelan, N. Huélamo, J. M. Alcalá and B. Rouzé <i>Spectro astrometry of the H<math>\alpha</math> emission of T Cha</i>	771
A. Caratti o Garatti, R. Cesaroni, L. Moscadelli, B. Stecklum, A. Sanna, R. Garcia Lopez, T. Ray, J. Eislöffel, R. Oudmaijer, W.-J. de Wit and C.M. Walmsley <i>First disk-mediated accretion burst from a massive protostar</i>	773
D. Coffey, F. Bacciotti, L. Podio and J. Erkal <i>The near-UV: the true window on jet rotation</i>	775
C. Contreras Peña, P. W. Lucas, D. Minniti, R. Kurtev and J. Borissova <i>Eruptive variable protostars from VVV</i>	777
W. J. de Wit, M. Beltrán, A. Caratti o Garatti, S. Kraus, R. Oudmaijer and P. Boley <i>Accretion-ejection in massive YSOs</i>	779
N. Dylan Kee, S. Owocki, R. Kuiper and J. Sundqvist <i>Line-driven ablation of circumstellar disks</i>	781

E. Fiorellino, S. Pezzuto, S. J. Liu, M. Benedettini, E. Schisano, D. Elia, P. André, V. Könyves, B. Ladjelate and the Herschel Gould Belt Survey Consortium <i>A study of the cold cores population in the Serpens star-forming region</i>	783
L. Haemmerlé, P. Eggenberger, G. Meynet, A. Maeder, C. Charbonnel and R. S. Klessen <i>Massive star formation by accretion: how to circumvent the angular momentum barrier?</i>	785
M. Jung and R. Banerjee <i>Simulations of the early phases of protostellar disc evolution with radiation transfer</i>	787
J. S. Kim, M. Fang, C.J. Clarke, S. Facchini, I. Pascucci, D. Apai and J. Bally <i>Young stellar objects &amp; photoevaporating protoplanetary disks in the Orion's sibling NGC 1977</i>	790
A. Kölligan and R. Kuiper <i>From accretion to outflows of massive protostars</i>	793
M. Kunitomo, T. Guillot, T. Takeuchi and S. Ida <i>Revisiting the pre-main sequence evolution of stars: importance of accretion efficiency and deuterium abundance</i>	795
F. Lopez-Martinez and J. F. Gameiro <i>Connection between the accretion and outflow processes in T Tauri stars</i>	797
J. C. Mottram, H. Beuther, A. Ahmadi, F. Bosco and the CORE Team <i>CORE: linking sites of high-mass star formation with their surroundings</i>	799
A. Murphy, E. Whelan, F. Bacciotti, C. Dougados, T. Ray, D. Coffey, J. Alcalá, P. García, F. Comerón and J. Eislöffel <i>A combined MUSE / X-Shooter study of the TH28 Jet</i>	801
H. Nagahara and K. Ozawa <i>The role of initial protostellar disk size on the chemical evolution of the disk</i>	804
S. Pezzuto, E. Fiorellino, M. Benedettini, E. Schisano, D. Elia, P. André, V. Könyves, B. Ladjelate, J. Di Francesco, L. Piccotti and the Herschel Gould Belt Survey Consortium <i>A study of the cold cores population in the Perseus star-forming regions</i>	806
A. Postel, M. Audard, E. Vorobyov, C. Rab, O. Dionatos and M. Güdel <i>A Herschel survey of outbursting sources</i>	808
E. Redaelli, F. O. Alves, P. Caselli, J. E. Pineda and the GAS team <i>The dynamics of a young protostellar core</i>	810
P. Sanhueza <i>The formation of high-mass binary systems by core/disk fragmentation: very early results</i>	812

A. Sanna, L. Moscadelli, R. Cesaroni, A. Caratti o Garatti, K. M. Menten, A. Kölligan and R. Kuiper <i>ALMA observations towards G023.01–00.41</i>	814
C. Sauty, V. Cayatte, K. Tsinganos, J. J. G. Lima, R. M. G. de Albuquerque and J. F. Gameiro <i>Accretion and jet simulations in YSOs</i>	816
S. Skinner, M. Audard, M. Güdel and C. Schneider <i>HST &amp; Chandra observations of the RY Tau jet</i>	818
B. Tofflemire, R. Mathieu, G. Herczeg, D. Ardila, R. Akeson, D. Ciardi and C. Johns-Krull <i>Accretion dynamics in pre-main sequence binaries</i>	820
K. Tomida, M. N. Machida, T. Hosokawa, Y. Sakurai and C. H. Lin <i>Grand design spiral arms in a young forming circumstellar disk</i>	822
M. Vioque R. D. Oudmaijer and D. Baines <i>HR diagram of Herbig Ae/Be stars and their infrared excesses</i>	824
<b>Young Stellar Clusters</b>	
E. J. Alfaro M. T. Costado M. González A. J. Delgado and the GES consortium <i>Phase-space structure in the Monoceros region: radial velocities and TGAS data</i>	826
K. Biazzo, A. Frasca, J. M. Alcalá, M. Zusi, E. Covino, S. Randich, M. Esposito, C. F. Manara, S. Antoniucci, B. Nisini, E. Rigliaco, F. Getman and L. Spina <i>Elemental abundances in star-forming regions. Results in Lupus and future analysis in Orion</i>	828
L. Bravi <i>The Gaia-ESO Survey: kinematical and dynamical study of four young open clusters</i>	830
N. Kaltcheva, G. Topasna and V. Golev <i>Strömgren-H<math>\beta</math> photometry and optical polarization study of young open clusters</i>	832
R. E. Miura, D. Espada, K. Nakanishi, A. Hirota and H. Sugai <i>Super-star-cluster forming clouds in the young starburst galaxy NGC5253</i>	834
R. J. Parker <i>The initial conditions of star formation from spatio-kinematics</i>	836
A. Pérez-Blanco, R. D. Oudmaijer and D. Baines <i>The clustering properties of intermediate mass young stars</i>	838
I. Pillitteri, S. J. Wolk and S. T. Megeath <i>Ages and distances to star forming regions from the synergy of X-rays and IR observations</i>	840
B. Shukirgaliyev, G. Parmentier, A. Just and P. Berczik <i>Impact of a star-formation efficiency profile on the evolution of open clusters</i>	842

G. Suárez, C. Román-Zúñiga and J. J. Downes <i>Photometric determination of the system IMF of the 25 Orionis stellar group</i>	844
K. Vaidya, S. Bhattacharya, V. Panwar, M. Samal, W.-P. Chen and D. K. Ojha <i>Star formation toward IRAS 10427-6032</i>	846
L. Venuti, L. Prisinzano, G. Sacco, E. Flaccomio, R. Bonito, F. Damiani, G. Micela, M. Guarcello, GES Collaboration and CSI2264 Collaboration <i>Age spread and sequential star formation in the young cluster NGC 2264</i>	848
N. J. Wright <i>OB associations are not the expanded remnants of star clusters</i>	850
S. A. Zhekov <i>X-rays from young clusters reveal binarity of massive stars</i>	852

## The First Stars

K. Bach and H.-W. Lee <i>Accurate determination of radiation damped profiles in the reionization epoch</i>	854
G. Chiaki, H. Susa and S. Hirano <i>Formation environment of Pop II stars affected by the feedbacks from Pop III stars</i>	856
L. Graziani, M. de Bennassuti and R. Schneider <i>Star formation in Milky Way progenitors</i>	858
K. Sugimura, C. M. Coppola, K. Omukai, D. Galli and F. Palla <i>Supermassive star formation with non-LTE primordial-gas chemistry</i>	860
H. Susa, S. Tanaka, G. Chiaki and N. Tominaga <i>Stellar wind prevents the ISM gas from accreting onto the PopIII stars</i>	862
K. M. J. Wollenberg, S. C. O. Glover, V. Bromm and R. S. Klessen <i>Stabilizing Population III accretion disks with magnetic fields</i>	864

## AFTERWORD

P. Tozzi <i>Francesco's last divertissement: the Little Prince's Universe</i>	866
--	-----