

## Chiara Eleonora Scardoni



### Title

The effect of the streaming instability on protoplanetary disc dust emission

### Abstract

According to the core accretion theory, rocky planets form by growing the initial micron-sized dust in protoplanetary discs up to the size of a planet. When the grains reach the size of 1 cm, however, the growth process faces a critical stage: the interaction with the disc gaseous component causes the cm-sized grains to drift rapidly towards the central star, becoming unavailable to form planets. Streaming instability (SI) is often invoked as a potential solution, as it promotes rapid dust overdensity formation. In my study, I simulated the action of SI through 2D local simulations, and computed the mm emission of resulting dusty clumps. Although the small size of the resulting dust clumps makes them inaccessible by direct observations (and thus we cannot directly compare the computed emission to the data), it is possible to define observable quantities, from which we can infer the presence of such substructures. By focusing on two observables – the optically thick fraction  $f_f$  (in ALMA band 6) and the spectral index  $\alpha$  (in bands 3-7) – I compared the distribution of simulations in the  $f_f$ - $\alpha$  plane before/after the action of streaming instability to recent multiwavelength data in the Lupus star forming region, finding that the action of SI drives the simulations towards the area of the plane occupied by the data. This study therefore suggests that clump formation via SI is consistent with recent observations, confirming that it can be considered a good idate to solve the radial drift barrier to planetesimal formation.

# Chiara Eleonora Scardoni

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## Education

- 2019–present **PhD student in Astronomy**, *University of Cambridge*, UK.  
PhD topic: dust - gas interaction (focus on streaming instability), planet - disc interaction (focus on massive planet migration)  
Supervisor: Prof. Cathie J. Clarke.
- 2019 **Postgraduate course - FOR24**, *University of Milan*, Italy, Teaching training.
- 2017–2019 **Master's Degree in Physics**, *University of Milan*, Italy, 110/110 cum laude.  
Master's thesis topic: disc-dominated type ii migration in protoplanetary discs.  
Supervisors: Prof. G. Lodato, Dr. G. P. Rosotti.
- 2013–2017 **Bachelor's Degree in Physics**, *University of Milan*, Italy, 110/110 cum laude..  
Bachelor's thesis topic: study of the disc viscous evolution in the  $M - \dot{M}$  plane.  
Supervisor: Prof. G. Lodato.
- 2008–2013 **Liceo scientifico (Secondary School)**, *Istituto Salesiano Sant'Ambrogio*, Milan, Italy.  
100/100 cum laude.

## Summer schools

- 18/07/2018–20/07/2018 **Mini Course - An introduction to turbulence in magnetised plasmas**, *Instituto de Plasmas e Fusão Nuclear*, Lisbon, Portugal.
- 8/07/2018–14/07/2018 **Summer school on plasma physics, intense lasers and nuclear fusion**, *Instituto de Plasmas e Fusão Nuclear*, Lisbon, Portugal.
- 8/07/2018–14/07/2018 **Astrofisica su Mediterranea**, *INAF (Istituto Nazionale di Astrofisica)*, *CIFS (Consorzio Interuniversitario per la Fisica Spaziale)*, *Progetto Mediterranea*, Cyprus.

## Conferences and Workshops

- 20/12/2021 **Milan Christmas Meeting**, *University of Milan*, Italy, Talk.
- 3/02/2020 **Wednesday seminar**, *Institute of Astronomy*, University of Cambridge, UK, Talk.
- 20/12/2019 **Milan Christmas Meeting**, *University of Milan*, Italy, Talk.

## Supervision/mentoring

**Bachelor's thesis co-supervisor**, Rossella Anania (University of Milan).

## Scholarship and awards

- 2019 **Peterhouse Graduate Studentship**, Full funding for a PhD course at the University of Cambridge. Studentship awarded by the Governing Body of Peterhouse (college of Cambridge).
- 2017 **Fondazione Angelo Ghezzi Scholarship**, Scholarship for talented young people (under 28).
- 2013 **Registration in the National Excellence Honours Roll**, *MIUR (Italian Ministry of education and research)*.

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## Computer skills

Languages R, PYTHON, C, C++.  
Hydro-codes FARGO (grid code), ATHENA (hybrid code).  
Other L<sup>A</sup>T<sub>E</sub>X, OpenOffice, Microsoft Office.

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## Languages

Italian Mother tongue  
English Proficient user

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## Publications

**Scardoni, C. E.**, Booth, R. A., Clarke, C., 2021, MNRAS, 504, p.1495-1510, doi:10.1093/mnras/stab854. *The effect of the streaming instability on protoplanetary disc emission at millimetre wavelengths.*

Manara, C. F.; Natta, A.; Rosotti, G. P.; Alcalá, J. M.; Nisini, B.; Lodato, G.; Testi, L.; Pascucci, I.; Hillenbrand, L.; Carpenter, J.; Scholz, A.; Fedele, D.; Frasca, A.; Mulders, G.; Rigliaco, E., *Astronomy & Astrophysics*; **Scardoni, C.**; Zari, E.. *X-Shooter survey of disk accretion in Upper Scorpius I. Very high accretion rates at age > 5 Myr.*

**Scardoni, C. E.**, Rosotti, G. P., Lodato, G., Clarke, C., 2020, MNRAS, 492, p.1318-1328, doi:10.1093/mnras/stz3534. *Type II migration strikes back – An old paradigm for planet migration in discs.*

Lodato, G., **Scardoni, C. E.**, Manara, C. F., Testi, L. 2017, MNRAS, 472, p.4700-4706, doi:10.1093/mnras/stx2273. *Protoplanetary disc 'isochrones' and the evolution of discs in the  $M - \dot{M}$  plane.*

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## Other work experience

2020–2021 **Welfare officer**, MCR committee of Peterhouse, Cambridge, UK.  
2018–2019 **Scientific guide in didactic laboratories**, FLA (Fondazione Lombardia per l'Ambiente), Seveso (MB), Italy.  
2017 – 2019 **Secondary school teacher (Liceo Scientifico)**, Istituto Salesiano Sant'Ambrogio, Milan, Italy.  
Physics teacher in summer and winter remedial courses for secondary school students.