UCL on $\overline{\text{MSFR}}$

PREAMBLE

Understanding the formation and evolution of galaxies is a current key research topic. It has become clear that in order to advance this subject, we need to understand the detailed physics of massive stars and their interactions with their environments. In particular, feedback processes are expected to play a crucial role in the formation of galaxies. White & Rees (1978) showed that negative feedback is required to prevent all the baryonic matter cooling and condensing into stars, and thus leaving no gas available to form the intergalactic medium (IGM). Today, all current cold dark matter models require feedback in the form of energy released from young stellar populations to regulate star formation. Observational evidence for feedback is seen in the galactic winds associated with local starburst galaxies, indicating a close association between the ejecta of massive stars (stellar winds and supernovae) and the interstellar medium. Powerful galactic winds are also observed in high redshift Lyman break galaxies (Pettini et al. 2001) and may be responsible for chemically enriching the IGM at high redshift (e.g. Ellison et al. 2000).

Studies of the evolution and interaction of massive stars with their environments are central to our understanding of galaxy evolution. The Hot, Massive Star group at UCL has developed over the last three decades to become one of the leading international centres for research on Wolf-Rayet, OB and related stars. We currently have five permanent staff, four post-docs, and six PhD students associated with the UCL Hot Massive Star Group. In addition, we have close contacts with the Molecular Astrophysics/ Star Formation Group with one staff member and one PPARC Advanced Fellow working in the area of massive star formation.

I will organise an internal UCL meeting to quantify exactly which members of staff are interested in joining the network, and what they can contribute. In particular, I will talk to the two star formation people since we mentioned that we needed people in this area at the Cambridge meeting.

In the meantime, I list below my own thoughts on objectives, and current collaborations. This may well change depending on how many people at UCL I can get onboard.

• *Feedback from resolved young massive clusters*

Stellar winds and supernovae explosions release huge amounts of energy and enriched material into their surroundings. Observationally, these feedback processes result in galactic-scale winds which are centred on young massive clusters. To understand this phenomenon, we need to know the efficiency of the conversion of stellar kinetic energy (winds plus SNe)into the energy required to drive the outflow. This efficiency parameter is not known with any accuracy because radiative losses cannot be easily quantified in inhomogeneous media. Yet, it is an essential number – one that needs to be known because of the importance of feedback processes in the formation of galaxies. One promising method to determine efficiencies is to study resolved young massive clusters in the Galaxy and Magellanic Clouds. By performing an inventory of the massive stars, and using an evolutionary synthesis code, the energy output can be predicted. This can then be compared with observations of the dynamics of the surrounding gas to deduce efficiencies. By studying a sample of resolved YMCs over a range of metallicities and environments (e.g. clusters near the Galactic Centre, 30 Dor in the LMC, NGC 346 in the SMC), it should be

possible to determine empirically the conversion efficiency.

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Resources required:
One PhD student and one post-doc. I would expect the PhD student to work on the topic outlined above of measuring the efficiency of feedback by analysing observations (some existing; some to be applied for) of resolved young massive clusters.

Collaborations:
R. de Grijs (Sheffield): young massive clusters in starburst galaxies.
P. A. Crowther (Sheffield): mass and energy return from clusters.
D. Schaerer (Geneva): Wolf-Rayet galaxies.