CASTALIA – A MISSION TO A MAIN BELT COMET. G. H. Jones[1], K. Altwegg[2] , I. Bertini[3], A. Bieler[4], H. Boehnhardt[5], N. Bowles[6], A. Braukhane[7], M. T. Capria[8], A. J. Coates[1], V. Ciarletti[9], B. Davidsson[10], C. Engrand[11], A. Fitzsimmons[12], A. Gibbings[13], O. Hainaut[14], M. Hallmann[15], A. Herique[16], M. Hilchenbach[5], M. Homeister[13], H. Hsieh[17], E. Jehin[18] W. Kofman[16], L. M. Lara[19], J. Licandro[20], S. C. Lowry[21], F. Moreno[19], K. Muinonen[22] , M. Paetzold[23], A. Penttilä[22], Dirk Plettemeier[24], D. Prialnik[25], U. Marboeuf [2], F. Marzari[26], K. Meech[27], A. Rotundi[28,29], A. Smith[1], C. Snodgrass[30], I. Thomas[6], M. Trieloff[31], [1]UCL Mullard Space Science Laboratory, University College London, Holmbury St. Mary, Dorking, Surrey RH5 6NT, UK (g.h.jones@ucl.ac.uk), [2]U. Bern, CH, [3]U. Padova, IT, [4]U. Michigan, USA, [5]MPS, Göttingen, DE, [6]U. Oxford, UK, [7]DLR, Bremen, DE, [8]INAF/IAPS, Rome, IT, [9]LATMOS/UVSQ, Guyancourt, FR, [10]U. Uppsala, SE, [11]CNRS, Paris, FR, [12]QUB, Belfast, UK, [13]OHB System AG, Bremen, DE, [14]ESO, [15]DLR, Bremen, DE, [16]IPA/UJF, Grenoble, FR, [17]Academia Sinica, Institute of Astronomy & Astrophysics, Taiwan, [18]U. Liège, BE, [19]IAA, Granada, ES, [20]IAC, Tenerife, ES, [21]U. Kent, Canterbury, UK, [22]U. Helsinki, FI, [23]U. Köln, DE, [24]TU Dresden, DE, [25]U. Tel Aviv, IL, [26] INFN, Padova, IT, [27]IfA, Honolulu, USA, [28]Università di Napoli "Parthenope", IT, [29] INAF-IAPS, Roma, IT, [30]Open U., UK, [31]U. Heidelberg, DE

Main Belt Comets (MBCs), a type of Active Asteroid, constitute a newly identified class of solar system objects. They have stable, asteroid-like orbits and some exhibit a recurrent comet-like appearance. It is believed that they survived the age of the solar system in a dormant state and that their current ice sublimation driven activity only began recently. Buried water ice is the only volatile expected to survive under an insulating surface. Excavation by an impact can expose the ice and trigger the start of MBC activity. We present the case for a mission to one of these objects, to be submitted to the European Space Agency's current call for an M-class mission.

The specific science goals of the Castalia mission are:

1. Characterize a new Solar System family, the MBCs, by in-situ investigation
2. Understand the physics of activity on MBCs
3. Directly sample water in the asteroid belt and test if MBCs are a viable source for Earth's water
4. Use the observed structure of an MBC as a tracer of planetary system formation and evolution.

These goals can be achieved by a spacecraft designed to rendezvous with and orbit an MBC for a time interval of some months, arriving before the active period for mapping and then sampling the gas and dust released during the active phase. Given the low level of activity of MBCs, and the expectation that their activity comes from only a localized patch on the surface, the orbiting spacecraft will have to be able to maintain a very close orbit over extended periods - the Castalia plan envisages an orbiter capable of 'hovering' autonomously at distances of only a few km from the surface of the MBC.

The strawman payload comprises a Visible and near-infrared spectral imager, Thermal infrared imager, Radio science, Subsurface radar, Dust impact detector, Dust composition analyser, Neutral/ion mass spectrometer, Magnetometer, and Plasma package. In addition to this, a surface science package is being considered.

At the moment, MBC 133P/Elst-Pizarro is the best-known target for such a mission. A design study for the Castalia mission has been carried out in partnership between the science team, DLR and OHB System AG. This study looked at possible missions to 133P with launch dates around 2025, and found that this, and backup MBC targets, are reachable by an ESA M-class mission.

A proposal in response to the ESA M4 call for missions is currently being prepared. More details, and an opportunity to register your support for the proposal, are available at http://bit.ly/mbcmission