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Bordeaux, February 5th 2016

This document formalizes the invitation made to Mr Tarek Trabelsi to stay in the theory group at the ISM for a period of one and a half month between the 15<sup>th</sup> of March and the 30 of April. The proposed work will be dedicated to the theoretical study of the inelastic collisions of the AIO<sup>+</sup> diatomic molecules with Helium. This system has been chosen for two purposes. It is first first a good test of the recent experimental finding by Hudson et al [1] that buffer gas vibrational cooling can be very efficient for cationic molecules. The second aim is to obtain the rotational excitation rate coefficients for this molecule which will be needed to model its abundance in the interstellar medium as AIO has already been detected while its cationic form is still to detect. This student was involved in the determination of the potential energy surface of the SN + H<sup>-</sup> and SH + N<sup>-</sup> collisions calculated in the group of Majdi Hochlaf in Marnes la vallée and fitted at the ISM in Bordeaux. The group in Bordeaux has developed its own scattering code and is also experienced in the calculation of PES. The time of his stay will be dedicated to the calculation of the *ab initio* grid of points and to the fitting while the dynamics will be done later on.

Thierry Stoecklin

1. W. G. Rellergert, S. T. Sullivan, S. J. Schowalter, S. Kotochigova, K. Chen, and Eric R. Hudson, Nature **495**, 490 (2013)



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