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To : STSM committee
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Dear committee,

The STSM entitled “Investigating clumpy AGN models with UV/optical polarimetry” that took place at the Observatoire astronomique de Strasbourg, France, has been successfully achieved.

During our two weeks of collaboration with René Goosmann, we developed a series of clumpy model for active galactic nuclei (AGN) and ran Monte Carlo radiative transfer simulations in order to extract the polarization signature from fragmented media. We reproduced several uniform-density torus models from the literature and explored the differences in terms of spectroscopy and polarization between the uniform-density tori and their clumpy counterparts. Exploiting the computational power of our code, we also pushed forward our uniform-to-clumpy investigations to other AGN reprocessing regions, namely the outflowing winds and the accretion flows. Combining the radiation-supported equatorial region with the dusty torus and the polar outflows, we then modeled AGN only made of clumpy structures and compared them to their non-fragmented counterparts.

Several major changes appeared: equatorial distributions of clumps, either for a dusty torus or an ionized accretion flow, tend to decrease the net polarization percentage, independently of the filling factor. The resulting polarization position angle depends on the half- opening angle and on the size of the given region. Extended clumpy configurations with half-opening angles inferior to 45 degrees give rise to parallel (with respect to the projected symmetry axis of the model) polarization for type-1 and type-2 viewing angles, while similar compact yet fragmented tori produce perpendicular polarization. A residual photon flux always manages to escape from the central parts of the model even when considering an observer’s line of sight passing through the highly-covered equatorial region. Moreover, this equatorial flux is carrying an important polarization degree that might be detected if not diluted by star-light emission. In the case of scattering regions distributed along the polar directions, the impact of fragmentation is reduced: a small number of clouds is able to properly reproduce the polarization behavior of uniform-density models. Increasing the cloud distribution only results in increasing the net polarization percentage as the total optical depth increases along. Like in the uniform-density density case, fragmented outflows solely produce perpendicular polarization angles.

We further continued our work on X-ray reprocessing in AGN winds and in irradiated, ionized accretion disks. For this purpose, a new and so-far unique Compton scattering routine has been implemented and tested. This routine takes into account Compton scattering off bound electrons in ions. The computation of our planned model grids has been prepared and partly started.

In conclusion, the goals set at the beginning of the STSM have been successfully reached and we even have been beyond the scope of our initial project by analyzing a panel of other clumpy media. The results from this STSM will be submitted for publication in Astronomy and Astrophysics. A rather advanced draft has been submitted to our collaborator for final comments.

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