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The first IRAM/PdBI polarimetric millimeter survey of active galactic nuclei. II. Activity and properties of individual sources

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We present an analysis of the linear polarization of six active galactic nuclei - 0415+379 (3C~111), 0507+179, 0528+134 (OG+134), 0954+658, 1418+546 (OQ+530), and 1637+574 (OS+562). Our targets were monitored from 2007 to 2011 in the observatory-frame frequency range 80-253 GHz, corresponding to a rest-frame frequency range 88-705 GHz. We find average degrees of polarization m_L ~ 2-7%; this indicates that the polarization signals are effectively averaged out by the emitter geometries. We see indication for fairly strong shocks and/or complex, variable emission region geometries in our sources, with compression factors <0.9 and/or changes in viewing angles by >10 deg. An analysis of correlations between source fluxes and polarization parameter points out special cases: the presence of (at least) two distinct emission regions with different levels of polarization (for 0415+379) as well as emission from a single, predominant component (for 0507+179 and 1418+546). Regarding the evolution of flux and polarization, we find good agreement between observations and the signal predicted by "oblique shock in jet" scenarios in one source (1418+546). We attempt to derive rotation measures for all sources, leading to actual measurements for two AGN and upper limits for three sources. We derive values of RM = -39,000 +/- 1,000 (stat) +/- 13,000 (sys) rad/m^2 and RM = 420,000 +/- 10,000 (stat) +/- 110,000 (sys) rad/m^2 for 1418+546 and 1637+574, respectively; these are the highest values reported to date for AGN. These values indicate magnetic field strengths of the order ~0.0001 G. For 0415+379, 0507+179, and 0954+658 we derive upper limits |RM| < 17,000 rad/m^2. From the relation |RM| ~ nu^a we find a = 1.9 +/- 0.3 for 1418+546, in good agreement with a = 2 as expected for a spherical or conical outflow.

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