discussed. Conclusions are given in Section VII.

II. GEOMETRY

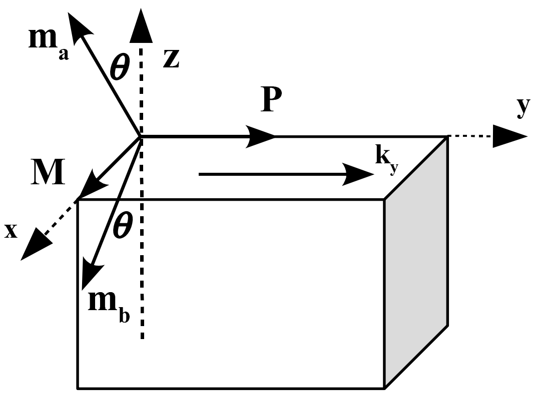

FIG. 1. Geometry. Canting of two magnetic sublattices (m_a and m_b) by an angle θ produces a weak ferromagnetism (M) along the $\hat{x}$ axis parallel to the surface. The spontaneous polarization ($\vec{P}$) is assumed to lie in a plane parallel to the surface. Propagation of the surface mode is along the $\hat{y}$ axis with wavenumber $\vec{k}_y$.

The geometry is sketched in Fig.1. We consider a semi-infinite multiferroic film that fills the half space $z < 0$. The magnetic component of the multiferroic is a two sub-lattice antiferromagnet with uniaxial magnetic anisotropy. The two magnetic sub-lattices are allowed to cant in the $x - z$ plane with canting angle, θ. We assume symmetric canting such that $|\vec{m_a}| = |\vec{m_b}| = M_s$. The canting generates a weak ferromagnetism which is perpendicular to the spontaneous polarisation. This configuration represents a Dzyaloshinkii-Moriya canting driven by spontaneous polarisation. Both the weak ferromagnetic moment and spontaneous polarisation are constrained to lie in $x - y$ plane, parallel to the surface. The magnetic easy axis is out-of-plane, along the z direction. An external electric field is applied parallel to the spontaneous polarisation, and an external magnetic field is applied along the weak ferromagnet moment.

For the polariton propagation, we consider in this paper transverse magnetic (TM) polarization in which the magnetic part of the electromagnetic wave propagates parallel to the surface. We consider only surface modes traveling along the $\hat{y}$ direction, so that the magnetic component lies in $\hat{x}$ direction while the electric component has E_y and E_z components.