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A theoretical model for the generation of Kinetic Alfvén Waves (KAWs) in the Earth's magnetosphere by ion beam and velocity shear

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A generation mechanism of the Kinetic Alfvén Waves (KAWs) by the ion beam and velocity shear will be discussed. For this, a three component plasma model consisting of cold background ions, hot electrons and hot ion beams is considered. The model is very general in the sense that all the three species have drifting Maxwellian distribution, non-uniform streaming and velocity shear and can be applied to magnetospheric regions where velocity shear is present. The effect of ion beam alone and the combined effect of the ion beam as well as the velocity shear in exciting the KAWs will be discussed. It is found that the ion beam alone can excite these KAWs. However, in the presence of ion beam along the ambient magnetic field and negative velocity shear or antiparallel ion beam and positive shear, the wave growth is much larger as compared to ion beam case alone. Also, the anti-parallel ion beam and positive shear can excite the KAWs with significantly higher growth rate as compared to the negative shear and parallel ion beam. The effect of plasma parameters such as species temperature, number density, angle of propagation etc. on the growth of the waves will be discussed. The present model is applied to auroral region of Earth's magnetosphere and it can explain several characteristic properties of the observed ultra low-frequency waves. The mechanism presented here can excite the KAWs upto the frequency of 30 mHz, which can explain the ultra-low-frequency waves observed in the auroral/polar cusp region. The model can be applied to any region of Magnetosphere, where, velocity shear is found.