A prominent example of anisotropic spin-orbital models is the Kitaev-Heisenberg (KH) model on the honeycomb lattice \[1,2\]. This model was proposed as the minimal model to describe the low-energy physics of the quasi two-dimensional compounds, Na$_2$IrO$_3$ and Li$_2$IrO$_3$. In these compounds, Ir$^{4+}$ ions are in a low spin $5d^5$ configuration and form weakly coupled hexagonal layers. Due to strong SOC, the atomic ground state is a doublet where the spin and orbital angular momenta of Ir$^{4+}$ ions are coupled into $J_{\text{eff}} = 1/2$. The KH model describing the interactions between $J_{\text{eff}}$ moments contains two competing nearest neighbor interactions: an isotropic antiferromagnetic Heisenberg exchange interaction originated mainly from direct direct overlap of Ir $t_{2g}$ orbitals and a highly anisotropic Kitaev exchange interaction \[3\] which originates from hopping between Ir $t_{2g}$ and O $2p$ orbitals via the charge-transfer gap.

We study critical properties of the KH model on the honeycomb lattice at finite temperatures \[4,5\]. The model undergoes two phase transitions as a function of temperature. At low temperature, thermal fluctuations induce magnetic long-range order by order-by-disorder mechanism. This magnetically ordered state with a spontaneously broken $Z_6$ symmetry persists up to a certain critical temperature. We find that there is an intermediate phase between the low-temperature, ordered phase and the high-temperature, disordered phase. Finite-size scaling analysis suggests that the intermediate phase is a critical Kosterlitz-Thouless phase with continuously variable exponents. We argue that the intermediate phase has been likely observed above the magnetically ordered phase in A$_2$IrO$_3$ compounds.