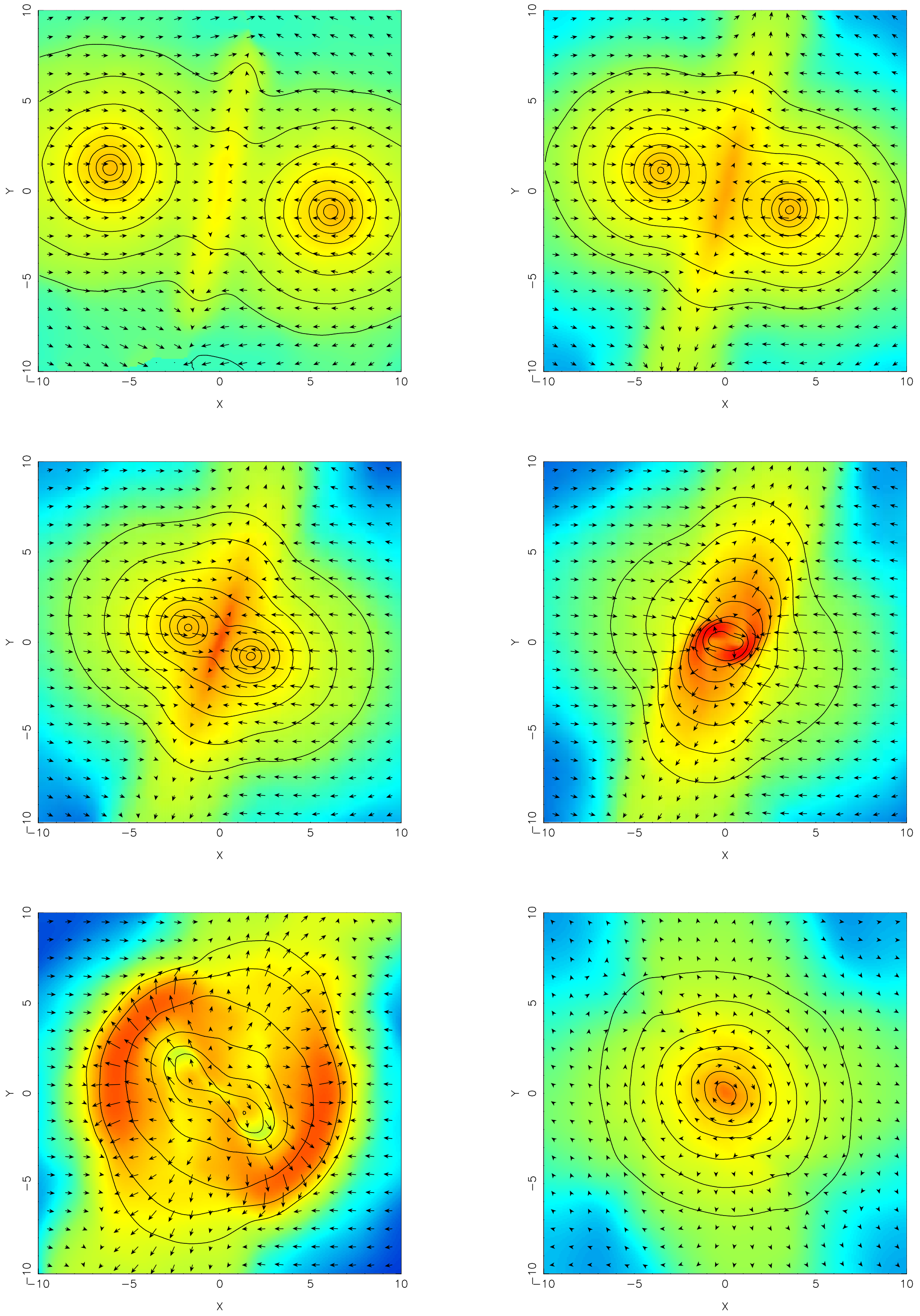
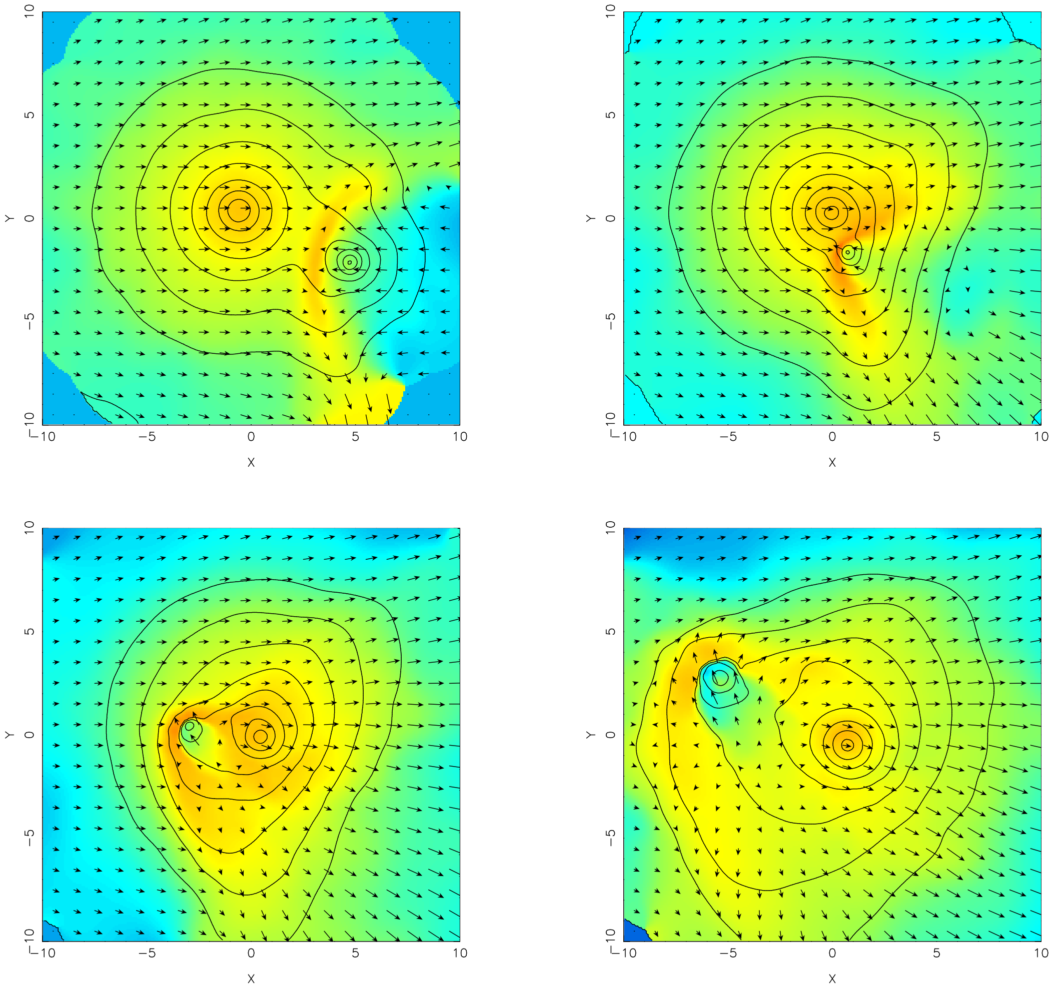
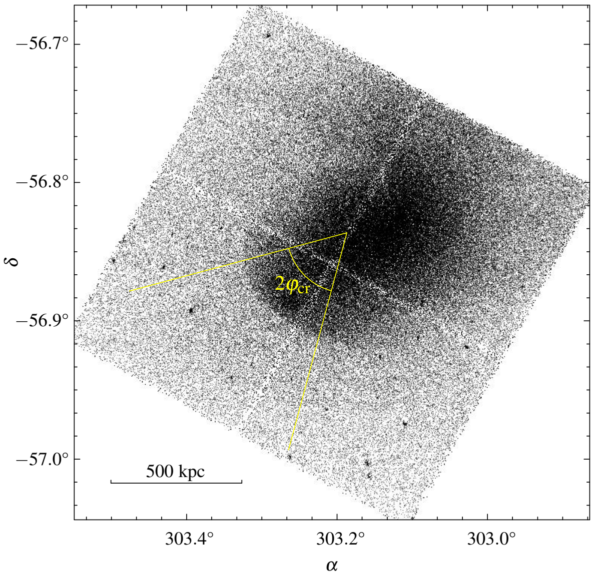
Merger simulations: equal mass, off-centre



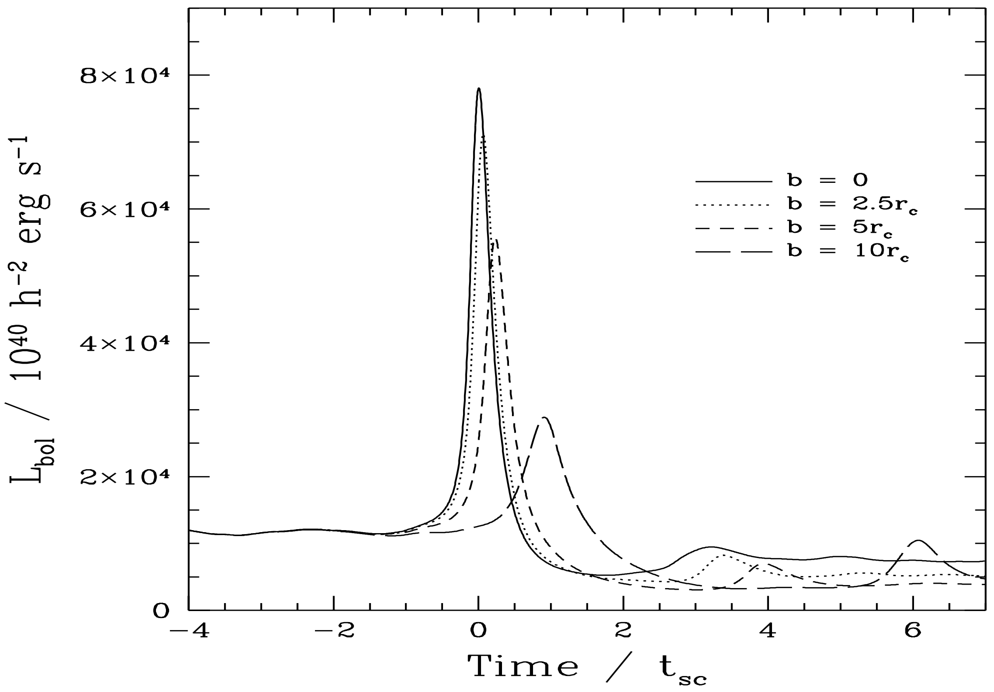
Merger simulations: unequal mass, off-centre

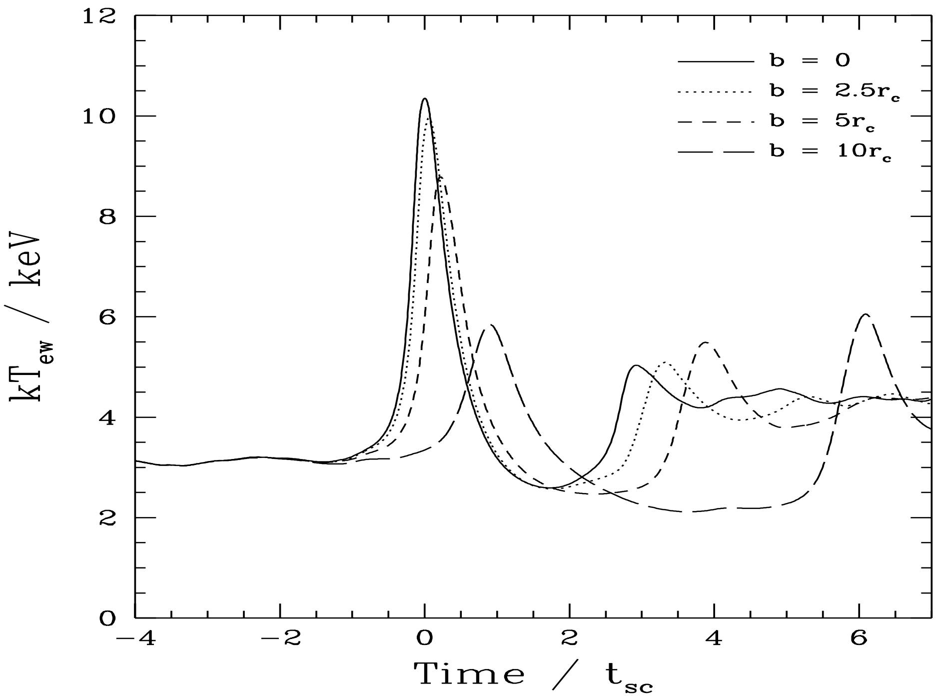


Note similarity of the final panel to this cold front observed by Vikhlinin, Markevitch & Murray (2001) in A3667.

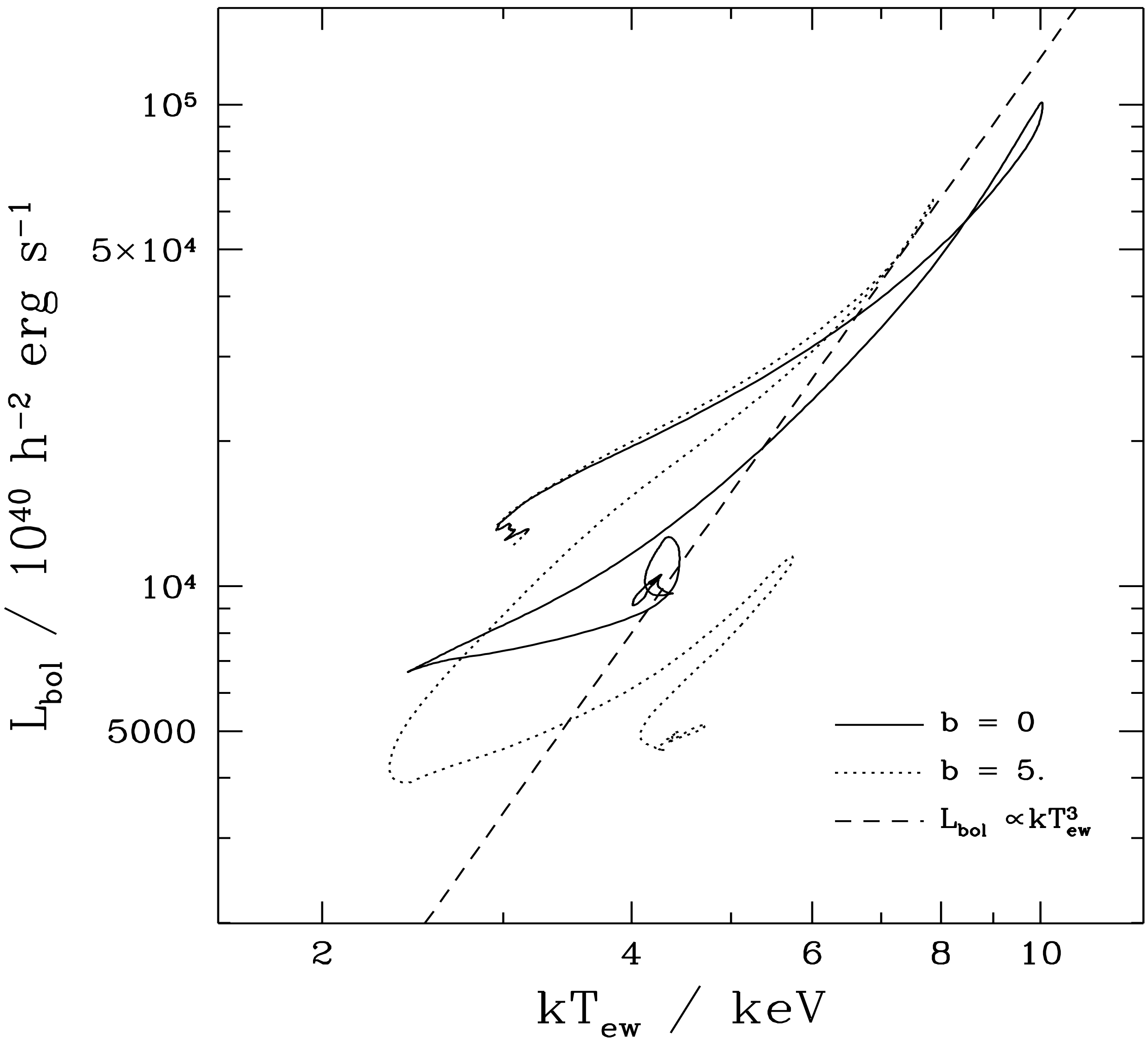


Simulated mergers: $L_{\rm bol}$ & $T_{\rm ew}$ evolution





Simulated mergers: $L_{\rm bol}$-$T_{\rm ew}$ evolution



The merging clusters make large excursions in the $L_{\rm bol}$-$T_{\rm ew}$ plane before settling down to a new equilibrium value. However these excursions are roughly parallel to the observed $L_{\rm bol}$-$T_{\rm ew}$ relation.

Conclusions

Cluster simulations show that cooling breaks the expected self-similarity between temerature and mass:

- in low-mass clusters $T_{\rm ew} > T_{\rm vir}$, but
- in high-mass clusters $T_{\rm ew} \sim T_{\rm vir}$
  - and shows the correct redshift scaling.

Both observations and simulations predict a steeper $L_{\rm bol}$-$T_{\rm ew}$ relation than is observed. However:

- observed clusters show little evolution in $L_{\rm bol}$-$T_{\rm ew}$ out to $z = 1$;
- simulated clusters predict stronger evolution.

Indivual clusters maintain an almost constant luminosity while their temperature changes by a factor of 10, however large excursions in temperature and luminosity are seen during merger events:

- this adds scatter to the $T_{\rm ew}$-M relation, but
- the excursions are roughly parallel to the observed $L_{\rm bol}$-$T_{\rm ew}$
  - relation.

Individual clusters show a wide variety of morphologies, incuding merger shocks and cold fronts.