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SDI Review Form 1.6

PART 1:

Journal Name:	Physical Review & Research International
Manuscript Number:	**2013_PRRI_4043**
Title of the Manuscript:	**A Fast and Simple Algorithm for Detecting Large Scale Structures**
Type of the Article	**Case study**

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- This form has total 7 parts. Kindly note that you should use all the parts of this review form.

PART 2: **Review Comments**

	Reviewer's comment	**Author's comment** *(if agreed with reviewer, correct the manuscript and highlight that part in the manuscript. It is mandatory that authors should write his/her feedback here)*
Compulsory REVISION comments	This paper describes a new method for the detection of large scale structure, based on the computation of the gravitational potential of a set of particles. Although the method is in principle interesting, I think that the technique has not reached a state of maturity, so I would not recomment this paper to be published. Here is a list of weak points that should be addressed before the paper may be considered for publication. 1) I have not found in the paper a clear definition of supercluster. I am no fan of these old-fashioned structures, because they are not supposed to be virialized and it is not clear to me what cosmological relevance they have. Why is the author concentrating on this kind of structures and not, say, on galaxy clusters as traced by galaxies? This paper would need, first, a clear definition of what a supercluster is, second, a justification of why it is important to better identify superclusters, beyond what has already been done. **Author's response:** Referring to what is the cosmological relevance of this work, I have tried to answer at the beginning of the Introduction; the specification on the definition of supercluster appears in Sect. 3.5. The choice of galaxy clusters as tracers has been re-motivated in Sect. 3.1.	

	2) The use of "bound structure" is to me confusing. Most cosmologists would immediately think to galaxy clusters, and notice that superclusters are not bound. However, according to spherical collapse every overdensity wrt the critical density is "bound", but this would make this definition not very useful. The author should be more clear in stating what he means by "bound structure", and clearly separate it from "relaxed" or "virialized" structure. **Author's response:** Added specification in Sect. 3.5 3) Superclusters are not relaxed nor virialized, so I can't see how the application of the virial theorem to a group of clusters can be justified. I don't think that a paper that contains such a computation of "virial mass" of a concentration of galaxy clusters should be accepted. (The fact that, in the far future, an overdensity will evolve into a virialized structure is no justification for using the virial theorem now). **Author's response:** In Sect. 3.6, before to apply the virial estimator, I have premised exactly your criticism, however, Small et al. (1998) evaluate convincingly the mass of the Corona Borealis supercluster (using 7 cluster members!) with virial estimators and tested the results via N-body simulations with excellent agreement. Specification has been added in Sect. 3.6 4) The described method should be extended to allow for a selection function, otherwise it is of little use in astronomy. Even the computation presented in this paper is based on an "approximately volume limited" sample with "high purity and completeness", meaning that corrections will be small, not that they can be neglected. **Author's response:** Please, see below in 6)	

	5) Galaxy clusters are highly biased tracers of the density field; the author assumes that the bias is linear, but I have not seen the assumed value of bias, is it set to uniy? **Author's response:** Yes, see specification in Sect. 3.2 ii) 6) I would not consider such a method of reconstruction of large-scale structure before it has been validated on mock catalogs based on N-body simulations. This would help in quantifying how the various, rather strong assumptions influence the result. **Author's response:** In principle, I agree with your criticism: a clustering algorithm that requires parameter tuning e.g. adaptive thresholds, linking lengths, cell sizes ect, should be validate comparing its results with mock catalogs in order to establish how much bias effects influences its accuracy. However, here the clustering algorithm is based on the determination of Φ that is an "unbiased" scalar quantity, model independent and does not require parameter tuning as demonstrated using a simulated sample in Sect.. 2 (see also Fig.1). It is merely a snapshot of the local spatial density led by gravity and measured, in this case, using the cluster mass distribution. Whether the dataset is a fair representation of a sample in real space little affected by bias effects (selection, redshift distortion etc.) then, the accuracy of the algorithm in evaluating Φ will just depend only **on the accuracy of the dataset.** Consequently, in the present context it would be more convenient to test datasets with mock catalogs rather than the algorithm. The dataset used here is extracted from GMBCG cluster catalog. The Authors claimed that it has been largely tested with mock catalogs and the catalog shows "high purity and completeness". However, the aim of this paper is to bring the attention of the astro-community on the GPM as a useful clustering algorithm to detect large scale structures. The application performed here is a simplified exemplification of how the GPM could be applied (as outlined in the preliminary statement of Sect.3 and in the Conclusions). A rigorous application of the GPM would need a complete volume-limited sample of clusters with reliable **spectroscopic** redshift and a richness-mass relation calibrated at higher redshift.	

	7) What about peculiar velocities? Individual peculiar velocities of galaxy clusters are very difficult to measure at high redshift, however they can be obtained from the kinematic SZ effect on the CMB photons by the hot gas in clusters of galaxies. Even if for each cluster the SZ term is small, by measuring a quantity derived from CMB data for a sizeable ensemble of many clusters, a coherent bulk flow can be evaluated. Since we study the distribution of local potential field induced by local cluster densities, then, locally, the dominant motion would be a common flow in the microwave background frame whereby, in average, the bias effect should be negligible at least at intermediate redshift. 8) The english should be carefully revised. **Author's response:** I made my best at least, I tried it..	
Minor REVISION comments		
Optional/General comments	I do not with my identity to be revealed to the author	