

November 30, 2007

Dr. A.C. Fabian  
Institute of Astronomy  
Madingley Road  
Cambridge, CB3 0HA  
United Kingdom

Dear Dr. Fabian:

Please accept the attached application for your postdoctoral position in X-ray astronomy advertised in the November 2007 issue of the AAS Job Register. For my thesis (advised by Megan Donahue and Mark Voit), entitled '*Feedback, Evolution, and Dynamics in Galaxy Clusters*', I am studying the coupling of feedback mechanisms – such as AGN, star formation, and conduction in cluster cores – to gas entropy, and the role of this feedback in altering global ICM properties and truncating the high mass end of the galaxy luminosity function. I have also been studying a method for quantifying the virialization state of clusters through the band dependence of X-ray temperatures. For my thesis I assembled a sample of 350 archival *Chandra* observations for 276 clusters totaling 11.6 Msec of data. The results of this laborious effort have been many and are detailed in my research summary.

I am a great asset for anyone studying active galaxies and clusters both for my technical skills and to furthering their research objectives. I feel the post-doctoral position under your advisory at IoA is an excellent fit for me, and your research goals will benefit from my addition. My expertise in X-ray astronomy ideally suits me to further work on better understanding AGN, models for galaxy formation, and feedback in clusters. Adaptation of my skill sets to study clusters in the radio, optical, and infrared is the next step in my career and should come with a short learning curve thanks to my existing, mature programming ability.

Along with this letter are my CV, a summary of past and current research, and a brief description of possible research directions. Letters of recommendation from Megan Donahue, Mark Voit, and Jack Baldwin will arrive under separate cover. Please do not hesitate to contact me if there is any further information I can provide as you review my application.

Thank you for your consideration.

Sincerely,

A handwritten signature in black ink, appearing to read 'Ken Cavagnolo', written over a light gray rectangular background.

Kenneth W. Cavagnolo  
Michigan State University

## RESUMÉ OF KENNETH W. CAVAGNOLO

**Office Address**

Michigan State University  
 Department of Physics & Astronomy  
 3265 Biomedical Physical Sciences Building  
 East Lansing, MI 48824-2320  
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 Web: [www.pa.msu.edu/people/cavagnolo/](http://www.pa.msu.edu/people/cavagnolo/)

**Education**      **Michigan State University**      2005 - Present

Ph.D. Astrophysics, Expected May-August 2008  
 Thesis Title: "Feedback, Evolution, and Dynamics in Clusters of Galaxies"  
 Thesis Advisors: Dr. Megan Donahue & Dr. G. Mark Voit

**Michigan State University**      2002 - 2005

M.S. Astrophysics

**Georgia Institute of Technology**      1998 - 2002

B.S. Physics *Cum Laude*

**Research**      **Graduate Research Assistant**      2003 - Present

**Experience** Supervisor: Dr. Megan Donahue, *Mich. St. Univ.*  
 Studying clusters of galaxies via their X-ray properties to  
 investigate feedback mechanisms, galaxy evolution, and the process  
 of cluster virialization.

**Graduate Research Assistant**      2002 - 2003

Supervisor: Dr. Jack Baldwin, *Mich. St. Univ.*  
 Analyzing echelle spectra for use in studies of *s*-process abundances  
 in planetary nebulae.

**Undergraduate Research Assistant**      2000 - 2002

Supervisor: Dr. James Sowell, *Georgia Tech*  
 Obtaining orbital solution for the eclipsing Algol binary ET Tau via  
 UVB light curves and spectroscopic radial velocity curves.

- Research**      • FEEDBACK MECHANISMS IN GALAXY CLUSTERS  
**Interests**      • GALAXY FORMATION  
                      • SUPERMASSIVE BLACK HOLES  
                      • AGN ACCRETION PHYSICS  
                      • LARGE SCALE STRUCTURE FORMATION AND COSMOLOGY

**Teaching**      **Substitute Instructor**      Fall 2006

**Experience** Course: "Visions of the Universe"  
 Gave lectures covering stellar evolution, supernovae, white dwarves,  
 neutron stars, and black holes.

**Physics Tutor**

Summer 2003

Course: "Introductory Honors Physics I &amp; II"

Tutored physics students taking introductory physics courses such as classical mechanics, optics, and electromagnetism.

**Graduate Teaching Assistant**

2002 - 2003

Course: "Visions of the Universe"

Directed and supervised laboratories for non-calculus based astronomy course.

**Honors**

- College of Natural Science Dissertation Fellow 2007 - Present
- American Astronomical Society Member 2002 - Present
- American Physical Society Member 2002 - Present
- NASA Center for Astronomy Education Participant 2007
- Sigma Pi Sigma National Honor Society 2001 - Present
- Dean's List, Georgia Tech 1998-2002

**Scientific Skills**

- Profound skills in reducing and analyzing data taken with *Chandra* X-ray Telescope.
- Extensive experience with CIAO and CALDB.
- Familiarity with multiwavelength analysis packages: AIPS, IRAF, and PyRAF.
- Fluent in Perl, IDL, LaTeX, and HTML.
- Working knowledge of Bash, C, CSH, Flash, Fortran, MySQL, and Supermongo.
- Mastery of multiple computing architectures: UNIX/Linux, Macintosh, and Windows.
- Expert of computer troubleshooting, maintenance, and system construction.

**First Author Refereed Papers***"Feedback Mechanisms in Galaxy Clusters and Alteration of ICM Entropy"***Cavagnolo, Kenneth W.**; Donahue, Megan; and Voit, G. Mark

2008, in prep.

*"Star Formation in BCGs: Resurrecting Conduction"***Cavagnolo, Kenneth W.**; Donahue, Megan; and Voit, G. Mark

2008, in prep. for ApJ Letters.

*"Athenaeum of Galaxy Cluster Entropy Profiles"***Cavagnolo, Kenneth W.**; Donahue, Megan; Voit, G. Mark; and Sun, Ming

2007, near ApJ Supplement submission.

*"X-ray Band Dependence of X-ray Temperatures in Galaxy Clusters"***Cavagnolo, Kenneth W.**; Donahue, Megan; Voit, G. Mark; and Sun, Ming

2007, near ApJ submission.

**Other Refereed Papers***"Star Formation, Radio Sources, Cooling X-Ray Gas and Galaxy Interactions in the Brightest Cluster Galaxy in 2A0335+096"*Donahue, Megan; Sun, Ming; O'Dea, Christopher P.; Voit, G. Mark; **Cavagnolo, Kenneth W.**[2007AJ....134...14D](#)*"Entropy Profiles in the Cores of Cooling Flow Clusters of Galaxies"*Donahue, Megan; Horner, Donald J.; **Cavagnolo, Kenneth W.**; Voit, G. Mark[2006ApJ...643..730D](#)

*"s-Process Abundances in Planetary Nebulae"*

Sharpee, Brian; Zhang, Yong; Williams, Robert; Pellegrini, Eric; **Cavagnolo, Kenneth**; Baldwin, Jack A.; Phillips, Mark; Liu, Xiao-Wei

[2007ApJ...659.1265S](#)

**Presented  
Work  
& Talks**

*"Library of Galaxy Cluster Entropy Profiles: A Study in Feedback"*

**Cavagnolo, Kenneth W.**; Donahue, Megan; Voit, G. Mark; and Sun, Ming  
2008 Winter Meeting of the American Astronomical Society, Poster

*"The Entropy-Feedback Connection and Quantifying Cluster Virialization"*

**Cavagnolo, Kenneth W.**; Donahue, Megan; Voit, G. Mark; and Sun, Ming  
2007 Eight Years of Science with Chandra Symposium, Poster

*"Chandra Studies of Dark Matter and Galaxy Formation: Signatures from the Intracluster Medium"*

Donahue, Megan; Sun, M.; **Cavagnolo, K.**; Voit, G.

[2006 Winter Meeting of the American Astronomical Society, Poster](#)

*"Abundances of s-process elements in planetary nebulae: Br, Kr & Xe"*

Zhang, Y.; Williams, R.; Pellegrini, E.; **Cavagnolo, K.**; Baldwin, J. A.; Sharpee, B.; Phillips, M.; Liu, X.-W.

[2006 IAU Symposium, Proceeding](#)

*"Studies of Entropy Distributions in X-ray Luminous Clusters of Galaxies"*

**Cavagnolo, K. W.**; Donahue, M. E.; Voit, G. M.; Sun, M.; Evrard, A. E.

[2005 Winter Meeting of the American Astronomical Society, Poster](#)

*"Entropy Distributions in the Cores of Nearby X-ray Luminous Clusters of Galaxies"*

**Cavagnolo, K. W.**; Donahue, M. E.; Voit, G. M.; Horner, D. J.; Evrard, A. E.

[2004 Winter Meeting of the American Astronomical Society, Poster](#)

*"Radio-Free Cluster Cooling Flows"*

Donahue, M. E.; Voit, G. M.; **Cavagnolo, K.**

[2004 Winter Meeting of the American Astronomical Society, Poster](#)

**References**

DR. MEGAN DONAHUE  
Department of Physics & Astronomy  
Michigan State University  
East Lansing, MI 48823  
(517)-355-9500 ext. 2418  
[donahue@pa.msu.edu](mailto:donahue@pa.msu.edu)

DR. G. MARK VOIT  
Department of Physics & Astronomy  
Michigan State University  
East Lansing, MI 48823  
(517)-355-9500 ext. 2419  
[voit@pa.msu.edu](mailto:voit@pa.msu.edu)

DR. JACK BALDWIN  
Department of Physics & Astronomy

Michigan State University  
East Lansing, MI 48823  
(517)-355-9500 ext. 2411  
[baldwin@pa.msu.edu](mailto:baldwin@pa.msu.edu)

- Personal**  
**Interests**
- Academic: environmental sciences, “Cradle2Cradle” design, and urban planning.
  - Athletics: triathlons, baseball, and everything Georgia Tech.
  - Hobbies: reading, building model airplanes, and raising bonsai trees.

## Summary of Past Research and Future Interests

The general process of galaxy cluster formation through hierarchical merging is well understood, but many details, such as the impact of feedback sources on the cluster environment and radiative cooling in the cluster core are not. Mergers and feedback activity are interesting for two reasons: they potentially compromise the use of clusters for cosmological studies, and there is a tremendous amount of interesting astrophysics going on. My thesis research has focused on studying the details of feedback and mergers via X-ray properties of the ICM in clusters of galaxies. I have paid particular attention to ICM entropy distribution and the role of AGN feedback in shaping large scale cluster properties. Additionally I have examined the quantification of cluster virialization via aspect-independent metrics, with emphasis on understanding temperature inhomogeneity as a surrogate for cluster dynamic state.

### Mining the CDA

My thesis makes use of a 350 observation sample (276 clusters; 11.6 Msec) taken from the *Chandra* archive. This massive undertaking necessitated the creation of a robust reduction and analysis pipeline which 1) interacts with mission specific software, 2) utilizes analysis software (i.e. XSPEC, IDL), 3) incorporates calibration and software updates, and 4) is highly automated. Because my pipeline is written in a very general manner, adding pre-packaged analysis tools from missions such as *XMM*, *Spitzer*, and *VLA* will be straightforward. Most importantly, my pipeline deemphasizes data reduction and accords me the freedom to move quickly into an analysis phase and generating publishable results.

### Quantifying Cluster Virialization

Cluster mass functions and the evolution of the cluster mass function are useful for measuring cosmological parameters. Cluster evolution tests the effect of dark matter and dark energy on the evolution of dark matter halos, and therefore provides a complementary and distinct constraint on cosmological parameters to those tests which constrain them geometrically (e.g. supernovae and baryon acoustic oscillations).

Empirically, the relationship of mass and some observable properties is well-established. However, if we could identify a set of parameters – possibly reflecting the degree of relaxation in the cluster – we could improve the utility of clusters as cosmological probes. The work of Mathiesen and Evrard 2001 found an auxiliary measure of substructure which does not depend on perspective and could be combined with power ratio, axial ratio, and centroid variation to yield a more robust metric for quantifying a cluster’s degree of relaxation.

I have studied this auxiliary measure: the bandpass dependence in determining X-ray temperatures and what this dependence tells us about the virialization state of a cluster. The ultimate goal of this project is to find an aspect-independent measure for a cluster’s dynamic state. To this end, I have investigated the net temperature skew in my sample of the hard-band ( $2.0_{rest}$ -7.0 keV) and full-band (0.7-7.0 keV) temperature ratio for core-excised apertures. I have found this temperature ratio is statistically connected to mergers and the presence of cool cores. The next step is to make a comparison to the predicted distribution of temperature ratios and their relationship to putative cool lumps and/or non-thermal soft X-ray emission in cluster simulations. This will be carried out by a fellow graduate student as part of his thesis and funded by a successful *Chandra* theory proposal by Dr. Mark Voit which was motivated by my work. In addition, this project has produced a first author paper which is near ApJ submission.

## Cluster Feedback and ICM Entropy

The picture of the ICM entropy-feedback connection (Fig. 1) emerging from my work suggests cluster radio luminosity and H $\alpha$  emission are anti-correlated with cluster central entropy ( $K = T_X n_e^{2/3}$ ). There also appears to be a bimodality in the distribution of central cooling times (Fig. 2) which is likely related to AGN feedback (and to a lesser extent, mergers). I have found that clusters with central entropy  $\leq 20$  keV cm<sup>2</sup> exhibit star formation (Fig. 3) and AGN activity (Fig. 4) in the BCG while clusters above this threshold unilaterally do not have star formation and exhibit diminished AGN radio feedback. This entropy level is auspicious as it coincides with the Field length,  $\lambda_F$ , (assuming reasonable suppression) at which thermal conduction can stabilize a cluster core. It is possible we have opened a window to solving a long-standing problem in massive galaxy formation (and truncation): how are ICM gas properties coupled to feedback mechanisms such that the system becomes self-regulating? However, this result serves to highlight unresolved issues requiring further intensive study.

### 1) What is the origin of the bimodality in $K_0$ ?

Is it archival bias? Meaning, are clusters with  $K_0 \sim 70$  keV cm<sup>2</sup> “boring” (and faint) and thus have not been proposed for observation? In which case I will select a representative sample of clusters from a flux-limited survey, such as *ROSAT* 400 $\square^\circ$ , which predictably fill this gap and observe them with *Chandra*. Or, is the gap physically driven? Is the gap representative of a very short period in a clusters life when AGN activity has boosted the core entropy to the point of being conductively stable ( $K_0 > 20$  keV cm<sup>2</sup>) and subsequent mergers have further elevated the ICM entropy to  $K_0 > 100$  keV cm<sup>2</sup>? A possible answer to this question may be found in analysis of simulations by asking the additional question: what is the timescale for depletion of  $\sim 10^{12-13} M_\odot$  subclusters in a full dark matter halo? If this timescale is of the order a few Gyrs then this likely points to a collusion of AGN feedback and mergers to give rise to bimodality. But ultimately the questions I posed are related with two primary underlying questions: what does the distribution of  $K_0$  for a complete sample of clusters look like? And what does the AGN energy injection distribution look like?

### 2) What role is star formation playing in the feedback cycle of clusters?

Thus far, indications from the literature are that most (possibly all?) BCGs in X-ray luminous clusters with  $K_0 \leq 20$  keV cm<sup>2</sup> are dominated by star formation. But we can see from Figure 4 that most of these systems contain radio AGN. So one can ask the question: are there any AGN dominated nebular BCGs? An interesting project to pursue with the *Spitzer* archive would be to examine the shape of spectral energy distributions (SEDs) for all clusters with a BCG and attempt to reveal if the BCG is star formation or AGN dominated. A cross-reference of my thesis sample (which is essentially the entire CDA) with the *Spitzer* data archive reveals 150+ clusters have already been observed by *Spitzer* (combinations of 75+ MIPS, 50+ IRAC, 30+ IRS) covering a broad entropy, luminosity (X-ray, H $\alpha$ , radio), and mass range. The large pool to draw from makes selection of a representative subsample immediately possible. Does star formation precede/inhibit/enhance/stunt AGN feedback? Currently we do not know. All we know is these two processes are triggered in cluster BCGs which reside in low entropy environments. Surely they are coupled somehow, which is why I highlighted several poor clusters/rich groups in Figures 3 and 4 with blue boxes and red stars. These systems are in the proper regime for feedback, yet they exhibit only one or neither of star formation or AGN. Follow-up of these objects with *Spitzer* and *XMM*’s Optical Monitor to search for polycyclic aromatic hydrocarbon features, UV excess, or dusty AGN would be interesting.

**3) How is energy generated on the parsec scale from a SMBH deposited uniformly in the ICM over a few cubic megaparsecs?**

As you are well aware and have shown quite elegantly through your work on Perseus, the role of AGN feedback in shaping global cluster properties is quite complex and to some extent poorly understood. Models for the process of thermalizing energy in AGN blown bubbles have been proposed, but details of these models still need to be explored. For example, do bubbles contain a very low density non-relativistic thermal plasma or are they truly voids in the ICM? We'd like to know if bubbles are pressure supported, and this could be studied via SZ effects. Radio sources are also being revealed as much more powerful than ever expected now that they have been observed at low radio frequencies (i.e. 330 MHz). Use of surveys such as LOFAR, LWA and EVLA will make study of clusters across a broad radio range a rich field for years to come. Also, what is the contribution of cosmic rays in bubbles? The presence of cosmic rays should be detectable with GLAST using observation of  $\gamma$ -rays from the decay of  $\pi^0$  in bubble lobes. How do bubbles rise to distances  $\geq 100$  kpc without being shredded by instabilities? What is the role of  $\vec{B}$  fields in stabilizing bubbles? And what is the origin of these fields? This area of cluster feedback studies is littered with more questions than current answers, which makes for an attractive research avenue for a post-doc to write many observing and grant proposals.

I have attempted to highlight without too much depth the areas I have already worked and the directions I would like to go. Most of my experience is with X-ray data, but multiwavelength analysis is the next necessary step in my career, and I hope it will be under your direction at IoA.



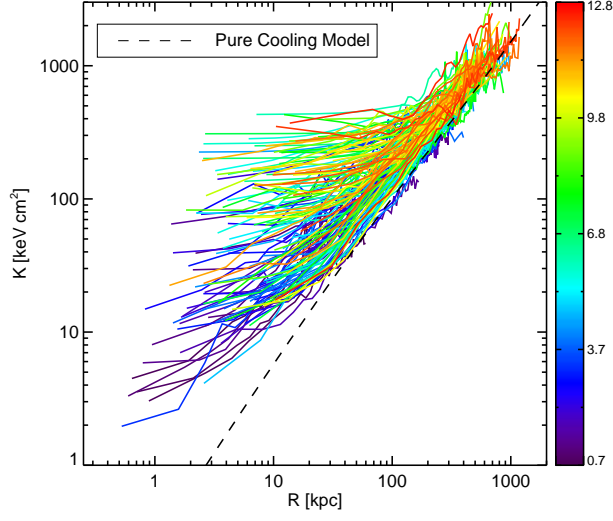


Figure 1: Radial entropy profiles of 143 clusters of galaxies in my thesis sample. The observed range of  $K_0 \lesssim 40 \text{ keV cm}^2$  is consistent with models of episodic AGN heating. Color coding indicates global cluster temperature (in keV) derived from core excised apertures of size  $R_{2500}$ .

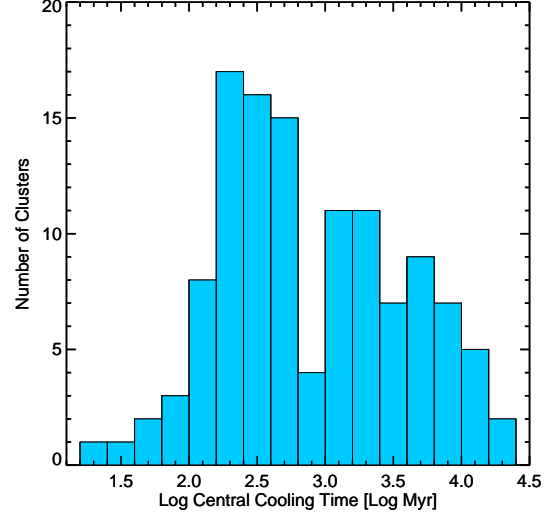


Figure 2: Distribution of central cooling times for an unbiased sub-sample of the clusters analyzed for my thesis. The peak in the range of cooling times (several hundred Myrs) is consistent with inferred AGN duty cycles of both weak ( $\sim 10^{40-50}$  ergs) and strong ( $\sim 10^{60}$  ergs) outbursts. However, note the distinct gap at  $0.6 - 1$  Gyr. An explanation for this bimodality does not currently exist.

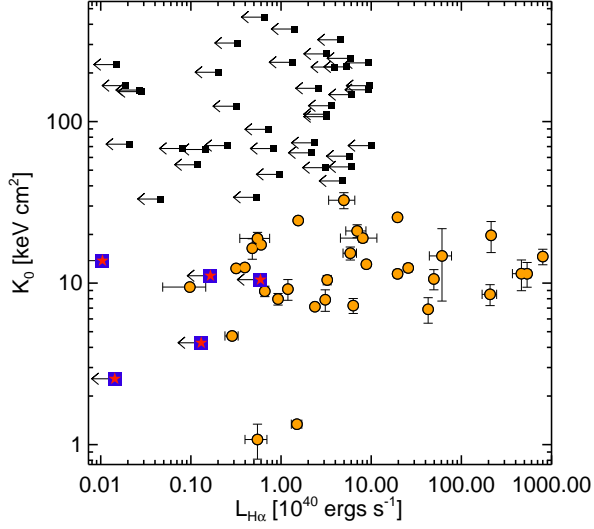


Figure 3: Central entropy plotted against  $H\alpha$  luminosity. Orange dots are detections, black boxes with arrows are non-detection upper-limits, and blue boxes with red stars are poor clusters/rich groups which do not match the trend. Notice the characteristic entropy threshold for star formation of  $K_0 \lesssim 20 \text{ keV cm}^2$ . This is also the entropy scale at which conduction no longer balances radiative cooling and condensation of low entropy gas onto a BCG can proceed.

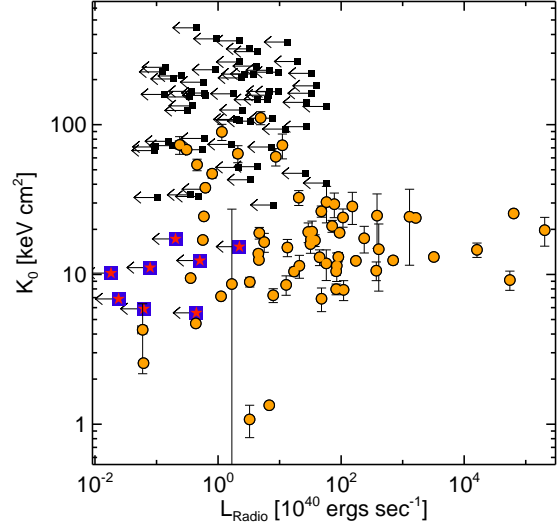


Figure 4: Central entropy plotted against NVSS or PKS radio luminosity. Orange dots are detections, black boxes with arrows are non-detection upper-limits, and blue boxes with red stars are poor clusters/rich groups which do not match the trend. There appears to be a dichotomy which might be related to AGN fueling mechanisms: AGN which are feed via low entropy gas, and the smattering of points at  $K_0 > 50 \text{ keV cm}^2$  which are likely fueled by mergers.

# Application for Employment – Cover Sheet - PD18



The information given will be processed for employment selection and statistical purposes. Applications will be retained for the successful candidate. Applications from unsuccessful candidates will be retained for up to twelve months. If you require this in an alternative format, contact the department to which you are applying.

This form is broken down into three parts. Part I contains information that will be used in the selection process. This should be completed by all applicants. Part II contains information for additional vetting. This is required for some posts and you will be advised accordingly. Part III is requested of all applicants and provides equal opportunity information. This information is not used as part of the selection process.

|                      |   |
|----------------------|---|
| Position applied for | <b>Postdoctoral researcher with the astronomy group led by Prof. Andy Fabian.</b> |
| Department           | <b>Institute of Astronomy</b>   |
| Vacancy Reference    | <b>LG02509</b>  |

## PART I

### PERSONAL DETAILS

|  |  |                     |
|--|--|---------------------|
| Forename(s)<br><b>Kenneth</b>  | Surname<br><b>Cavagnolo</b>  | Title<br><b>Mr.</b> |
| Current Address :<br><b>1111 Kimberly Dr.<br/>Apt. #7<br/>Lansing, MI, USA</b>                                 | Contact details:<br>(1) Daytime telephone: <b>1-517-285-9062</b><br>(2) Mobile: <b>1-517-285-9062</b><br>(3) E-mail address: <b>cavagnolo@pa.msu.edu</b> |                     |
| Post code:<br><b>48912</b>   | Do you require a work permit/permission to work in the UK? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>                           |                     |
| Current salary and any financial benefits:<br><b>~\$17,000 USD; full medical &amp; dental co-pay insurance</b> | Current notice period:<br><b>None required</b>   |                     |

### WORK REFERENCES

|  |
|--|
| References should normally be work related references and include your present employment (or your most recent employer) or course tutor if currently a student. For academic appointments, one of the references should be external to the University.<br>The job advertisement should indicate whether you are required to submit two or three references. |
| Name: <b>Dr. Megan Donahue</b>   |
| Position: <b>Michigan State University Professor</b>   |
| Address:<br><b>Department of Physics and Astronomy; Michigan State University<br/>Biomedical Physical Sciences Building<br/>East Lansing, MI, 48824-2320, USA</b>  |
| Telephone number: <b>1-517-355-9200 ext. 2418</b>  |
| E-mail address: <b>donahue@pa.msu.edu</b>  |
| Do we have permission to contact this referee before the interview? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>  |

|   |  |
|---|--|
| Name: <b>Dr. G. Mark Voit</b>   |  |
| Position: <b>Michigan State University Professor</b>  |  |
| Address:<br><b>Department of Physics and Astronomy; Michigan State University</b><br><b>Biomedical Physical Sciences Building</b><br><b>East Lansing, MI, 48824-2320, USA</b> |  |
| Telephone number: <b>1-517-355-9200 ext. 2419</b>   |  |
| E-mail address: <b>voit@pa.msu.edu</b>  |  |
| Do we have permission to contact this referee before the interview? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>                                       |  |

**Third Reference**

|   |  |
|---|--|
| Name: <b>Dr. Jack Baldwin</b>   |  |
| Position: <b>Michigan State University Professor</b>  |  |
| Address:<br><b>Department of Physics and Astronomy; Michigan State University</b><br><b>Biomedical Physical Sciences Building</b><br><b>East Lansing, MI, 48824-2320, USA</b> |  |
| Telephone number: <b>1-517-355-9200 ext. 2411</b>   |  |
| E-mail address: <b>baldwin@pa.msu.edu</b>   |  |
| Do we have permission to contact this referee before the interview? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>                                       |  |

**APPLICANT DECLARATION & DATA CONSENT**

I confirm that the information I have given in this application for employment form and any supporting documents is correct and complete.

I understand that failure to disclose any relevant information or the provision of false information may lead to dismissal and subsequent termination of contract of employment.

I understand that the University of Cambridge will carry out a verification process and will check all or any of the information provided on the application form, given in references and presented as proof of identity.

I agree for release of information under the provisions of the Data Protection Act 1998

I understand that an appointment, if offered, may be subject to a satisfactory medical examination.

If I have been required to submit Part II as part of the application process, I understand that the University of Cambridge will verify the information given in Part II, which might include referral to an appropriate third party for purposes of security clearance.

Signature .....**Kenneth W. Cavagnolo**.....

Date .....**11/20/2007**.....

## PART II

For additional vetting purposes, you are required to complete Part II of the application form. As instructed, please complete only the relevant section(s) below.

### A. FOR SELECTED APPLICATIONS

#### I Personal Details

|  |  |
|--|--|
| Maiden Name (if applicable)                                  |  |
| Date of birth: <b>January, 27<sup>th</sup> 1980</b>          | Place of birth: <b>Snellville, GA, USA</b>                           |
| Nationality: <b>American</b>                                 | National Insurance Number: <b>N/A</b>                                |
| Driving Licence No.:<br><b>C125465870072 Issued: MI, USA</b> | Passport No. and Issue Date:<br><b>207705508 Issued: 31 Jan 2003</b> |

#### II Personal Referees

Please complete the contact details for two referees who have known you in a personal capacity over the last five years. We may prefer to seek a written reference before the interview.

|   |   |
|---|---|
| Name: <b>Mr. Josh Winston</b>   | Name: <b>Mr. Chris Johnson</b>  |
| Position: <b>Senior Electrical Engineer</b>   | Position: <b>Entertainment Editor, Silicon Valley Business Journal</b>  |
| Address:<br><b>10700 Academy Rd. NE<br/>#1411<br/>Albuquerque, NM, USA<br/>Postcode:<br/>87111</b>                                      | Address:<br><b>700 Cypress Lane<br/>Campbell, CA, USA<br/>Postcode:<br/>95008-2111</b>  |
| Telephone number: <b>1-505-917-9957</b>   | Telephone number: <b>1-408-679-9996</b>   |
| E-mail address: <b>jwinstongt@yahoo.com</b>   | E-mail address: <b>CAJ@bizjournals.com</b>  |
| How long have they known you? <b>Seven years</b>  | How long have they known you? <b>Ten years</b>  |
| In what capacity have they known you?<br><b>College suitemate and close friend</b>  | In what capacity have they known you?<br><b>Long time friend -- became brother-in-law</b>   |
| Do we have permission to contact this referee before the interview? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> | Do we have permission to contact this referee before the interview? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> |

#### III Previous Address

If you have lived at your current address for less than 5 years, please give details of all addresses for the previous five years with dates below. (Continue on additional sheet if required.)

|                                  |                                 |
|----------------------------------|---------------------------------|
| From:<br>(month/year)<br>Address | To:<br>(month/year)<br>Postcode |
| From:<br>(month/year)<br>Address | To:<br>(month/year)<br>Postcode |

**IV Additional Checks**

- \* I authorise the Driver and Vehicle Licensing Agency to supply any information with the exception of any medical information that may be held on its driver computer record, relating to myself and my driving entitlement past and present including any valid endorsement, disqualifications etc (within the meaning of the Road Traffic Offenders Act 1988), to an external security service.

Signature ...**Kenneth W. Cavagnolo**..... Date ...**11/20/2007**.....

- \* I authorise the United Kingdom Passport Agency to supply any information held in its records regarding the details of my passport submitted with this application to an external security service.

Signature ...**Kenneth W. Cavagnolo**..... Date ...**11/20/2007**.....

- \* I request the information to be sent to external security service.

- \* I hereby consent to the external security service passing the results of the security vetting process to the University of Cambridge for the purpose of my application.

Signature ...**Kenneth W. Cavagnolo**..... Date ...**11/20/2007**.....

**B. FOR APPLICATIONS TO POSTS WORKING WITH CHILDREN AND VULNERABLE ADULTS OR TO SECURITY SENSITIVE AREAS**

The University of Cambridge actively promotes equality of opportunity for all, as stated in our Equal Opportunities policy. Any declaration would be treated in confidence and would not be used against applicants unfairly. A conviction does not automatically prevent you from being approved, however failure to declare will lead to immediate action.

Where it is a requirement of the post to submit an Enhanced Disclosure application to the Criminal Records Bureau this information will be treated in confidence. Any disclosed information will be discussed with short listed applicants. Any applicant that fails to reveal information relevant to the position applied for that is subsequently revealed on Disclosure may have their conditional offer of employment withdrawn.

This post is subject to the Rehabilitation of Offenders Act 1974. You should complete this section if you have any court action pending against you, been cautioned, or have criminal convictions that are not considered 'spent' under the Rehabilitation of Offenders Act 1974.

Have you ever been cautioned / convicted of a criminal offence / have any hearings pending? Yes ☐ No ☒

If 'YES' please give further information

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If you are applying for a post that is exempt from the provisions of the Rehabilitation of Offenders Act 1974 you must disclose ALL criminal convictions found against you (spent and unspent). The recruiting department will confirm if the post is exempt and therefore, what you must declare.

# EQUAL OPPORTUNITIES MONITORING SLIP

## PART III

The University is an Equal Opportunities employer and is committed to treating all job applications on their merits. The information provided here will not be used in considering your application but will be collected centrally to check that the University is treating all applicants on the basis of their ability to carry out the duties of the post irrespective of gender, race or disability. Please tick the boxes below. The information will be separated from the application form and will not be given to the selection panel.

|                         |                         |                |
|-------------------------|-------------------------|----------------|
| Vacancy Reference ..... | Office/Post Title ..... | For office use |
|-------------------------|-------------------------|----------------|

### Gender

*Tick the appropriate box to indicate your gender*

☐ Female

☒ Male

### Ethnic Origin

*Choose ONE section from A to E, then tick the appropriate box to indicate your background.*

#### A White:

☐ White – British

☐ White - Irish

☒ White - Other white background

#### B Mixed:

☐ White and Black Caribbean

☐ White and Black African

☐ White and Asian

☐ Any other mixed background

#### C Asian or Asian British:

☐ Indian

☐ Pakistani

☐ Bangladeshi

☐ Any other Asian background

#### D Black or Black British:

☐ Caribbean

☐ African

☐ Other Black background

#### E Chinese or Chinese British or other ethnic group:

☐ Chinese

☐ Any other background

### Disability

Do you regard yourself as in any way disabled?

☐ Yes

☒ No

### Advertising

Where did you first learn about this vacancy?

American Astronomical Society Monthly Job Register



