Faculty Review Documentation – 2016

Name: **Barnes, Joshua** **Rank:** **R5**

1 Introduction

Workload Distribution

Research	Teaching	Service & Support
34 %	33 %	33 %

My recent work at the IfA has been largely devoted to developing and implementing undergraduate programs in Astrophysics and Astronomy (approved Aug. 2014), to teaching courses associated with these programs, and to mentoring students. During the 2014–15 academic year, I was on sabbatical at the Yukawa Institute of Kyoto University, where I concentrated on research. In addition to my position at UH, I have an uncompensated Affiliate Professorship at the Yukawa Institute.

2 Research Activities

2.1 Research Accomplishments + Awards, Prizes, etc.

- **Tidal interactions as probes of dark matter**.
  Most "tests" for DM only probe static potentials; galaxy encounters involve DM in an active role. Halo structure has a unique and quantifiable influence on tidal interactions of galaxies. This work is the first to show that tidal morphology can provide two-sided constraints on halo mass and structure (Barnes 2016).

- **IDENTIKIT reconstruction of galaxy encounters**.
  Developed numerical approach to rapidly explore parameter space of galaxy interactions. Collaboraited with Privon et al. (2013, and in prep.) to produce new models of interacting systems in the GOALS (Great Observatories All-sky LIRG Survey) sample, and with Mortazavi et al. (2016) to demonstrate automated reconstruction of encounters from simulated IFU data. Recent work addresses uncertainties by generating an ensemble of models for each reconstructed system.

- **Characterization of merger morphology**.
  Collaborated with D. Sanders (IfA) on simple classification schemes for luminous IR galaxies in the GOALS and COSMOS (Cosmic Evolution Survey) samples. Contributed to analysis of classifications in Hung et al. (2013) and Larson et al. (2015).

- **Numerical methods for Vlasov-Poisson equations**.
  Invited to participate in VLASIX workshop held at Yukawa Institute and review N–body methods; proposed integration of orbits in chaotic potentials as challenging test for particle-free methods. Developed project to determine if collisional N-body systems mimic collisionless ones on short time-scales; ongoing work with J. Makino & M. Iwasawa (RIKEN AICS, Kobe).

2.2 Publications – Past 3 Years (Published, Accepted or Submitted)

Total Number of Refereed Papers in 2013–2015	8
First-author Refereed Papers	1
Second- or Third-author Refereed Papers	3

Refereed Articles: Major Contributions

[1] **Joshua E. Barnes** (2016), "Transformations of galaxies. III. Encounter dynamics and tidal response as functions of galaxy structure", *Mon. Not. R. astr. Soc.*, **455**, 1957. (Published online Nov. 19, 2015)

[2] S. Alireza Mortazavi, Jennifer M. Lotz, **Joshua E. Barnes**, Gregory F. Snyder (2016), "Modeling the Initial Conditions of Interacting Galaxy Pairs Using Identikit", *Mon. Not. R. astr. Soc.*, **455**, 3058. (Published online Nov. 26, 2015)

[3] G.C. Privon, **J.E. Barnes**, A.S. Evans, J.E. Hibbard, M.S. Yun, J.M. Mazzarella, L. Armus, J. Surace (2013), "Dynamical Modeling of Galaxy Mergers Using Identikit", *Astrophys. J.* **771**, #120.

Refereed Articles: Moderate Contributions

[1] K.L. Larson, D.B. Sanders, **J.E. Barnes**, C.M. Ishida, A.S. Evans, V. U, J.M. Mazzarella, D.-C. Kim, G.C. Privon, I.F. Mirabel (2015), "Morphology and Molecular Gas Fractions of Local Luminous Infrared Galaxies as a Function of Infrared Luminosity and Merger Stage', *Astrophys. J.*, submitted.

[2] Hung, C.-L., Sanders, D.B., Casey, C.M., Koss, M., Larson, K.L., Lee, N., Li, Y., Lockhart, K., Shih, H.-Y., **Barnes, J.E.**, Kartaltepe, J.S., Smith, H.A. (2014), "A Comparison of the Morphological Properties between Local and $z \sim 1$ Infrared Luminous Galaxies: Are Local and High–z (U)LIRGs Different?", *Astrophys. J.* **791**, #63.

[3] C.-L. Hung, D.B. Sanders, C.M. Casey, N. Lee, **J.E. Barnes**, P. Capak, J.S. Kartaltepe, M. Koss, K.L. Larson, E. Le Floc'h, K. Lockhart, A.W.S. Man, A.W. Mann, L. Riguccini, N. Scoville, M. Symeonidis (2013), "The Role of Galaxy Interaction in the SFR–M_* Relation: Characterizing Morphological Properties of Herschel-selected Galaxies at $0.2 < z < 1.5$", *Astrophys. J.* **778**, #129.

Refereed Articles: Minor Contributions

[1] Scoville, N., Sheth, K., Walter, F., Manohar, S., Zschaechner, L., Yun, M., Koda, J., Sanders, D., Murchikova, L., Thompson, T., Robertson, B., Genzel, R., Hernquist, L., Tacconi, L., Brown, R., Narayanan, D., Hayward, C.C., **Barnes, J.**, Kartaltepe, J., Davies, R., van der Werf, P., Fomalont, E., (2015), "ALMA Imaging of HCN, CS, and Dust in Arp 220 and NGC 6240", *Astrophys. J.* **800**, #70.

[2] Veilleux, S., Rupke, D.S.N., Kim, D.-C., Genzel, R., Sturm, E., Lutz, D., Contursi, A., Schweitzer, M., Tacconi, L.J., Netzer, H., Sternberg, A., Mihos, J.C., Baker, A.J., Mazzarella, J.M., Lord, S., Sanders, D.B., Stockton, A., Joseph, R.D., **Barnes, J.E.** (2014), "Erratum: 'Spitzer Quasar and ULIRG Evolution Study (QUEST). IV. Comparison of 1 Jy Ultraluminous Infrared Galaxies with Palomar-Green Quasars"', *Astrophys. J. Supp.* **213**, #36.

Significant Non-Refereed Publications

[1] **J.E. Barnes**, G.C. Privon (2013), "Experiments with IDENTIKIT", *Galaxy Mergers in an Evolving Universe*, ed. W.-H. Sun, C.K. Xu, N.Z. Scoville, and D.B. Sanders (Astronomical Society of the Pacific), p. 89.

2.3 Bibliometrics

	2013	2014	2015
Citations (first-author / all)	293 / 477	247 / 447	291 / 515
H index (first-author / all)	0 / 0	0 / 0	24 / 32

Your current m-index (2015): 1.0

2.4 Postdocs supervised

Name	Position	Dates	Description
N/A			

2.5 Invited Reviews, Research Talks and Colloquia

Date	Event	Location	Description
06/27/13	Research Talk	Astronomy Dept., Kyoto	Probing Galaxy Halos with Tidal Interactions
07/10/13	Research Talk	ELSI, Tokyo Tech.	Probing Galaxy Halos with Tidal Interactions
12/11/14	Colloquium	Yukawa Institute, Kyoto	Collisions as Probes of Galactic Structure
04/22/15	Research Talk	RIKEN AICS, Kobe	Galaxy Collisions: an Ensemble Approach
06/01/15	Invited Review	VLASIX, Kyoto	N–Body Methods: Review and Topics
08/07/15	Research Talk	IAU Div. J, Honolulu	Tidal Dynamics as Functions of Galaxy Structure

2.6 Research Grants & Other Research Funding – Past 3 Years

Existing Funding

Date Funded	Amount to UH	Role	Agency	Description
N/A				

Pending Proposals

Date Submitted	Amount to UH	Role	Agency	Description
N/A				

Unsuccessful Proposals

Date Rejected	Amount to UH	Role	Agency	Description
06/24/2015		PI	STScI	Dynamical Modeling of LIRGs

3 Teaching Activities

3.1 Graduate Students and Other students supervised

Name	Position	Dates	Description
K. Blumenthal	Grad student	F15–now	Astr 699: Merger-driven Inflows in Disk Galaxies
J. Chu	PhD student[1]	S11–now	Topic: Spectra of $z > 2$ Galaxies
Z. Gazak	PhD student[1]	F10–S14	Topic: Extragalacitc Red Supergiants
M. Gowanlock[2]	PhD student[1]	S13–S15	Topic: Distance Searches on Moving Object Trajectories
B. Hackett[3]	PhD student[1]	S13–now	Topic: Direct Detection of Dark Matter
I-T. Ho	PhD student[1]	F12–now	Topic: Shocks and Metallicity in Star-forming Galaxies
C.-L. Hung	PhD student[1]	S13–S15	Topic: Origin and Evolution of High-z (U)LIRGs
K. Larson	PhD student[1]	S10–S15	Topic: Stellar Populations in Local LIRGs
K. Lockhart	PhD student[1]	S14–now	Topic: Super Star Clusters and Galactic Winds
A. Man[4]	Visiting Student	S13	Topic: Mergers and Size Evolution of E Galaxies
G. Privon[5]	PhD student[1]	F10–S14	Topic: Atomic & Molecular Gas in LIRGs
P.-F. Wu	PhD student[1]	S14–now	Topic: Surface Brightness of Galaxies

[1] — JB serves as a dissertation committee member.
[2] — Department of Information and Computer Science, University of Hawaii at Manoa.
[3] — Department Physics and Astronomy, University of Hawaii at Manoa.
[4] — Dark Cosmology Centre, Neils Bohr Institute.
[5] — Astronomy Department, University of Virginia.

3.2 Regular Courses Taught During the Past 3 Years

Course	Sem.	Credits	Enroll	Eval	Title
A241	F13	3	4	5.00	Foundations of Astrophysics. I
A242	S14	3	5	5.00	Foundations of Astrophysics. II
A241	F15	3	8	4.75	Foundations of Astrophysics. I

3.3 Graduate Faculty Activities

☐ Taught a graduate-level class
☒ Served on a PhD committee
☐ Provided financial support for a graduate student
☒ Served on a graduate program committee

3.4 Comments on Teaching

Although on sabbatical in Fall 2014 – Spring 2015, I taught full-scale courses in three of the four semesters I spent at UH. I enjoyed teaching these courses and developed informal mentorships with several students; I provided letters of recommendation for two students from the S14 class of Astr 242.

The lecture notes, problem sets, and exams I developed for Astr 241 and 242 were made available to Andrew Howard and Nick Kaiser, respectively, who taught those courses while I was away. Both reported they found these resources useful.

As a dissertation committee member, I had occasion to work closely with Chao-Ling Hung and Kirsten Larson, and provided text which was incorporated into their papers and dissertations. I also wrote letters of recommendation for both of them.

My work with George Privon (at the time, IfA alum Aaron Evans' PhD student), was extremely rewarding. I hosted George during several visits to the IfA, and we have published several papers together, with more to come. I also wrote letters of recommendation for him, and after getting his PhD he moved on to a Postdoctoral Fellowship with Ezequiel Treister in Chile.

In Spring 2013, I worked intensively with Allison Man (at the time, Sune Toft's student, visiting from Denmark) on a project to simulate the size evolution of elliptical galaxies.

In support of Mike Gowanlock's PhD research and a related NSF proposal, I provided numerical simulations of disk galaxies which he used as test data.

4 Service & Support Activities

4.1 IfA Committees

Year	Committee	Workload	Description
2013–2014	Strategic Plan	60 hrs	Chaired Educational Working Group
2013–2015	Curriculum	intermittent	Discussion of Graduate Education
2014–2015	Undergrad	30 hrs/yr	Undergrad Education Task Force

4.2 UH Committees

Year	Committee	Workload	Description
N/A			

4.3 Community / Local Committees

Year	Committee	Workload	Description
N/A			

4.4 National / International Committees / Journal Editorships

Year	Organization	Workload	Description
2015–now	VLASIX	minimal, so far	SOC for next Valsov-Poisson workshop

4.5 Public Outreach Events

Date	Event	Location	Description
4/07/13	IfA Open House	IfA Manoa	Operated solar spectrograph
4/06/14	IfA Open House	IfA Manoa	Operated solar spectrograph
10/04/14	Moon Viewing	Kamo-gawa	Kyoto International School community event
8/03/15	IAU Stargazing	Magic Island	Public viewing with portable telescopes

4.6 Institutional Grants & Other Institutional Funding – Past 3 Years

Existing Institutional Funding

Date Funded	Amount	Role	Agency	Description
N/A				

Pending Institutional Proposals

Date Submitted	Amount	Role	Agency	Description
N/A				

Unsuccessful Institutional Proposals

Date Rejected	Amount	Role	Agency	Description
N/A				

4.7 Comments on Service & Support

- **Undergraduate Program Chair** (Fall 2015 – now).
  Responsible for undergraduate BA Astronomy and BS Astrophysics programs: recruiting students, advising and tracking students in programs, assigning instructors, scheduling classes, course evaluation, program assessment and revision, and supervising faculty mentorship of undergraduates. Specific tasks in 2015 include extensive catalog revisions, detailed report to UHM program assessment office, and implementation of in-house (IfA) course evaluation.

- **Undergraduate Program Development** (Spring 2013 – Summer 2014).
  Co-authored proposal for BS Astrophysics and BA Astronomy programs. Responsible for detailed 4-year academic plans, interfaces to community college and UH Hilo programs, assessment plans, large-scale curriculum maps, proposals for new courses, revisions to existing courses. Revised proposal to address recommendations and requirements from Office for Vice Chancellor for Academic Affairs, Senate Committee on Academic Policy and Planning, Council of Chief Academic Officers, and Vice Chancellor for Administration, Finance and Operations, prior to approval by Board of Regents (August 2014). Launched ongoing project to produce fine-grain curriculum map.

- **Strategic Planning** (Fall 2013 – Spring 2014).
  Chaired working group responsible for the Astronomy Education plan. Organized meetings of working group in Manoa and Hilo, recorded discussion, generated written summaries for wiki, drafted and edited text of education plan.

- **Faculty Review** (Spring 2013).
  Chaired FRC. Implemented changes mandated by the 2011 Faculty Retreat, including extensive modifications to the FRC form and associated FAQ. Wrote extensive analysis of results provided to the Faculty, and generated further data products for the Director.

- **VLASIX** (Fall 2015).
  Member of SOC for next "Vlasov-Poisson: towards numerical methods without particles" workshop, to be held in Marseille, Oct. 30 to Nov. 3, 2017.