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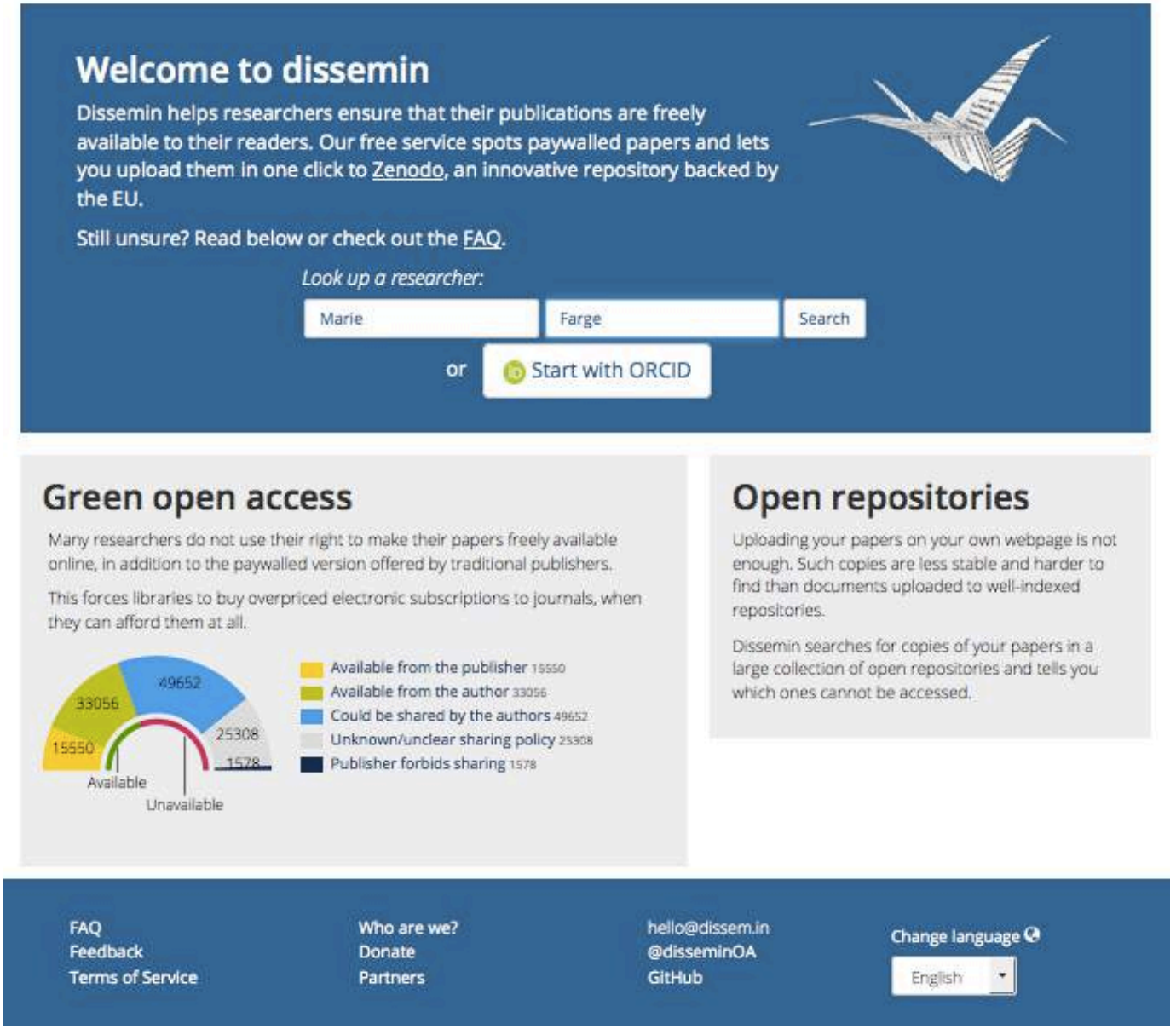

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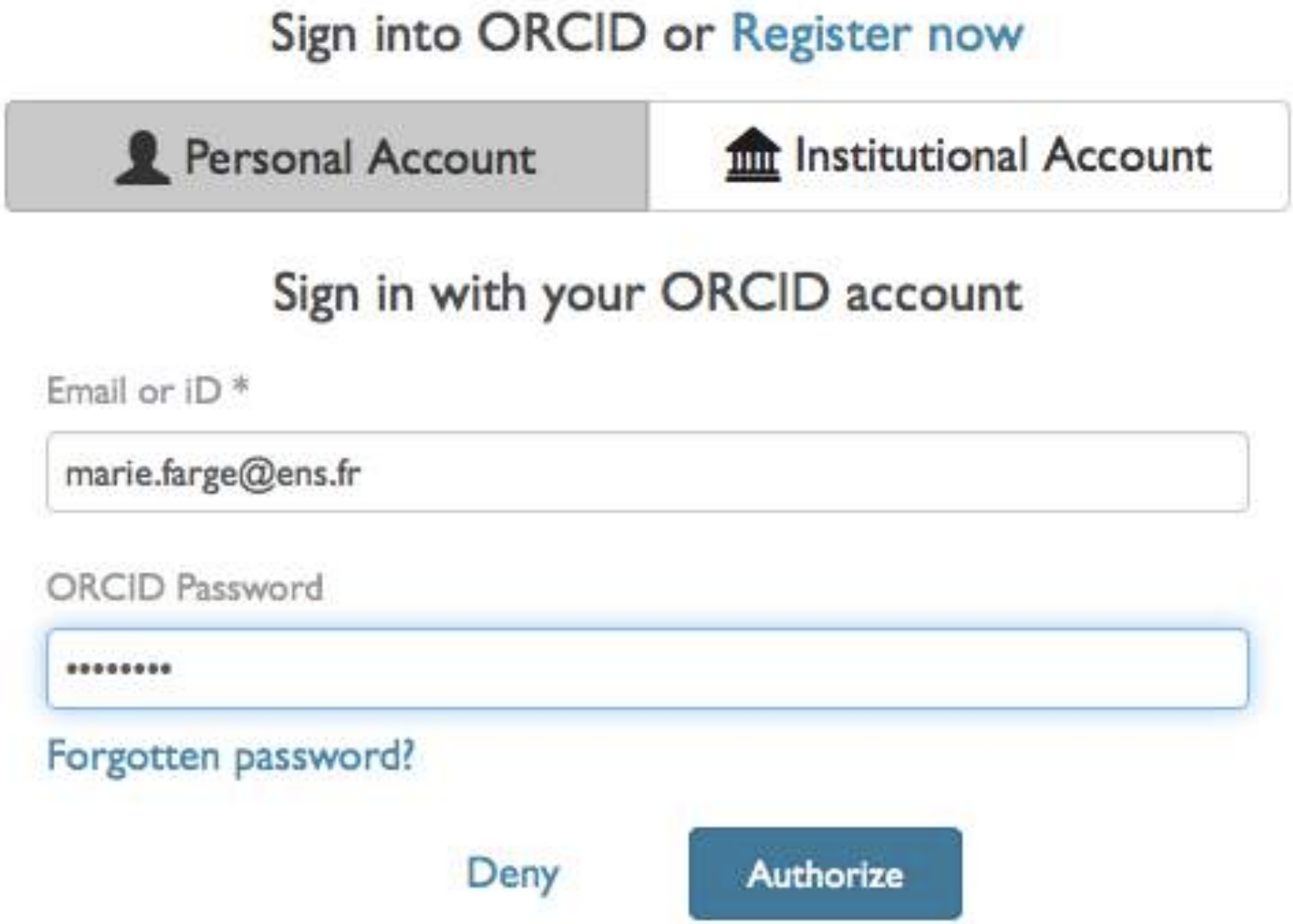

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Coherent vortex extraction in three-dimensional homogeneous turbulence: Comparison between CVS-wavelet and POD-Fourier decompositions

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(Received 22 November 2002; accepted 21 May 2003; published 2 September 2003)

The coherent vortex simulation (CVS) decomposes each realization of a turbulent flow into two orthogonal components: An organized coherent flow and a random incoherent flow. They both contribute to all scales in the inertial range, but exhibit different statistical behaviors. The CVS decomposition is based on the nonlinear filtering of the vorticity field, projected onto an orthonormal wavelet basis made of compactly supported functions, and the computation of the induced velocity field using Biot–Savart's relation. We apply it to a three-dimensional homogeneous isotropic turbulent flow with a Taylor microscale Reynolds number $R_\lambda = 168$, computed by direct numerical simulation at resolution $N = 256^3$. Only $2.9\%N$ wavelet modes correspond to the coherent flow made of vortex tubes, which contribute 99% of energy and 79% of enstrophy, and exhibit the same $k^{-5/3}$ energy spectrum as the total flow. The remaining $97.1\%N$ wavelet modes correspond to a incoherent random flow which is structureless, has an equipartition energy spectrum, and a Gaussian velocity probability distribution function (PDF). For the same flow and the same compression rate, the proper orthogonal decomposition (POD), which in this statistically homogeneous case degenerates into the Fourier basis, decomposes each flow realization into large

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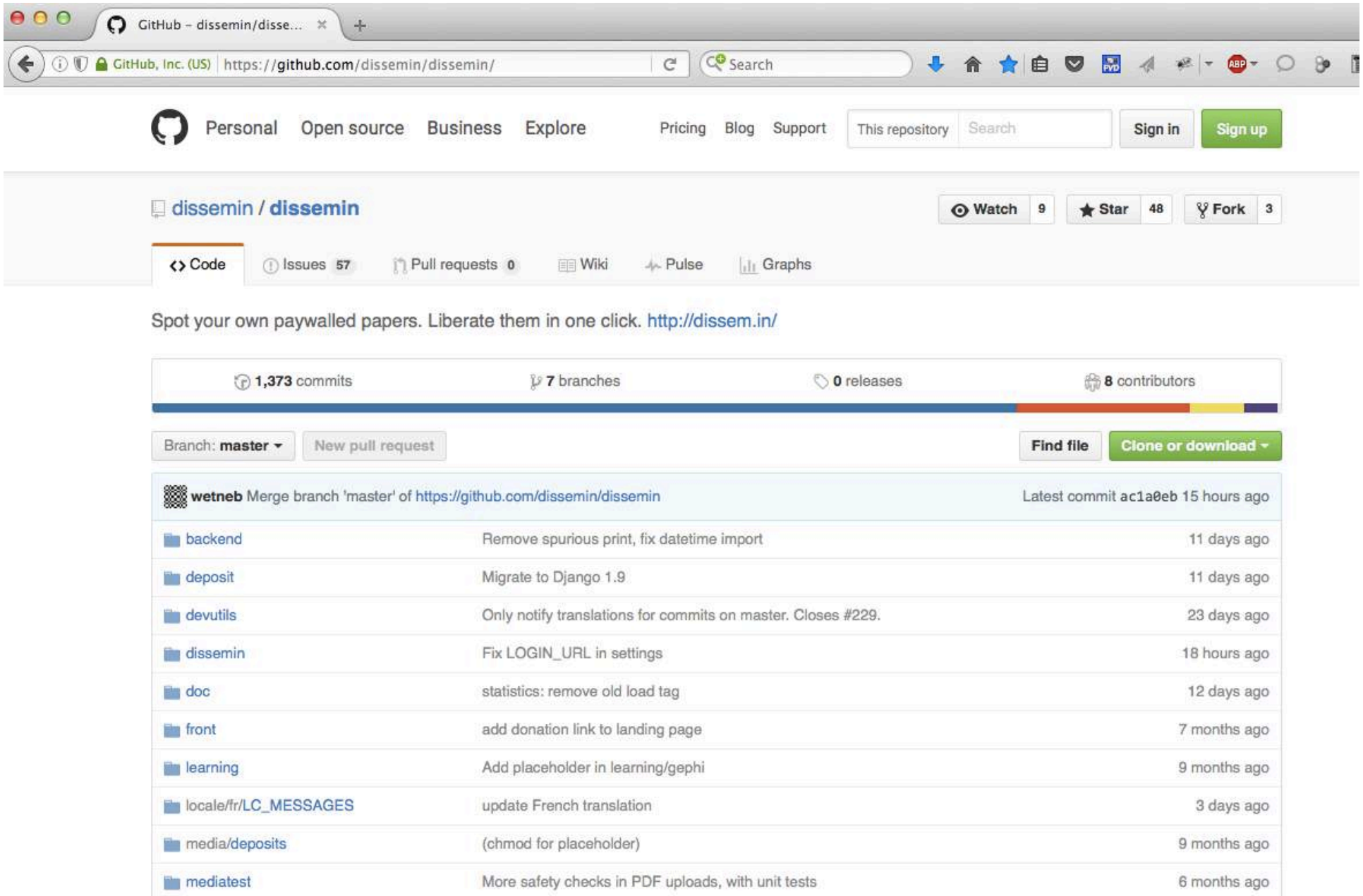

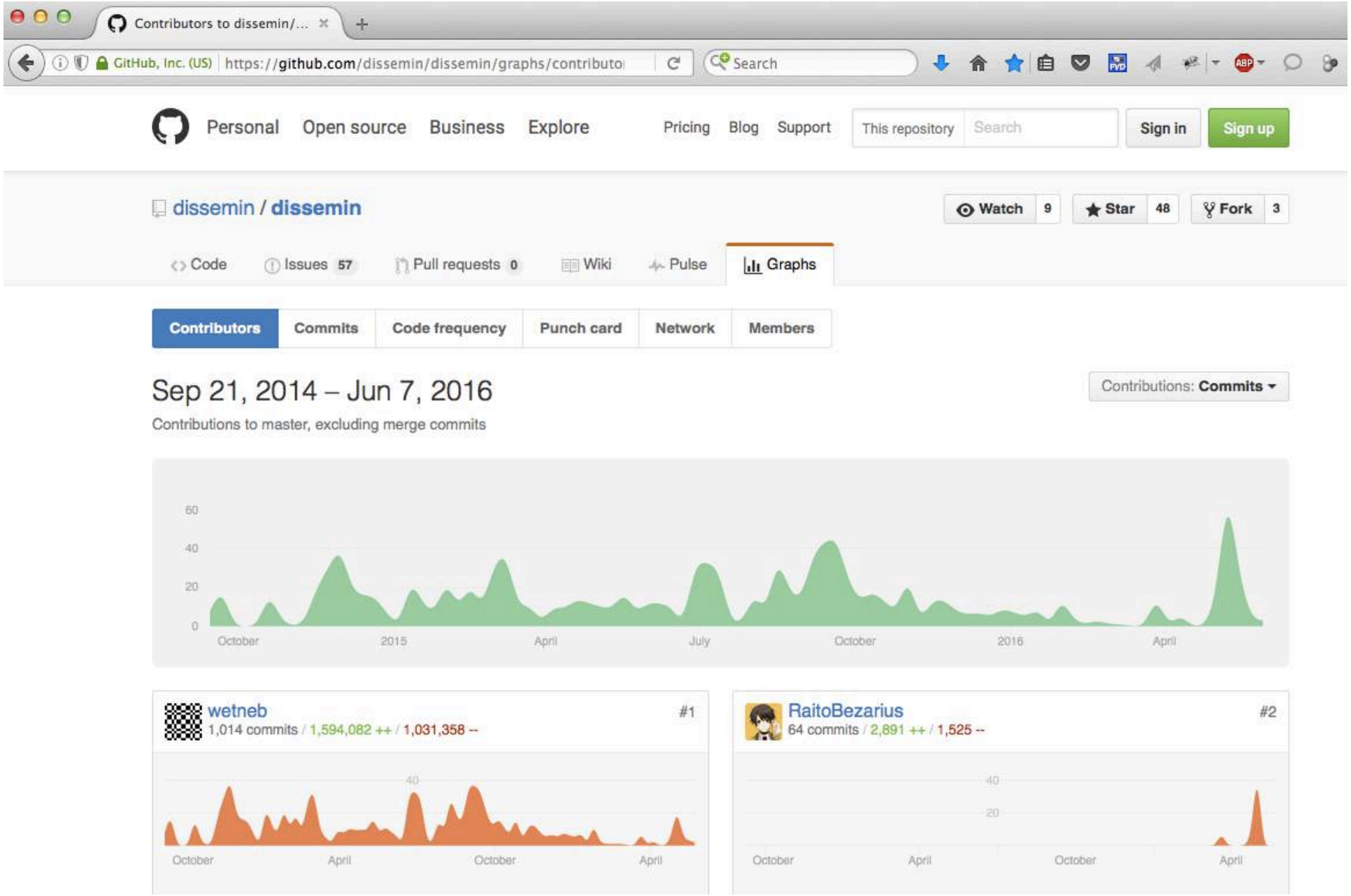

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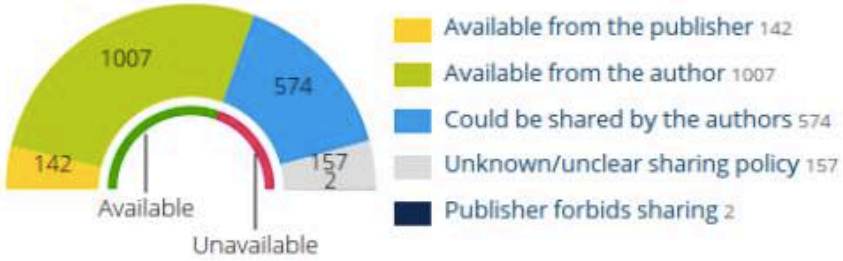

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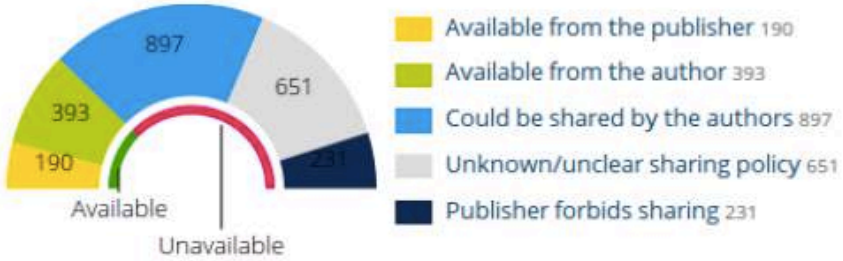

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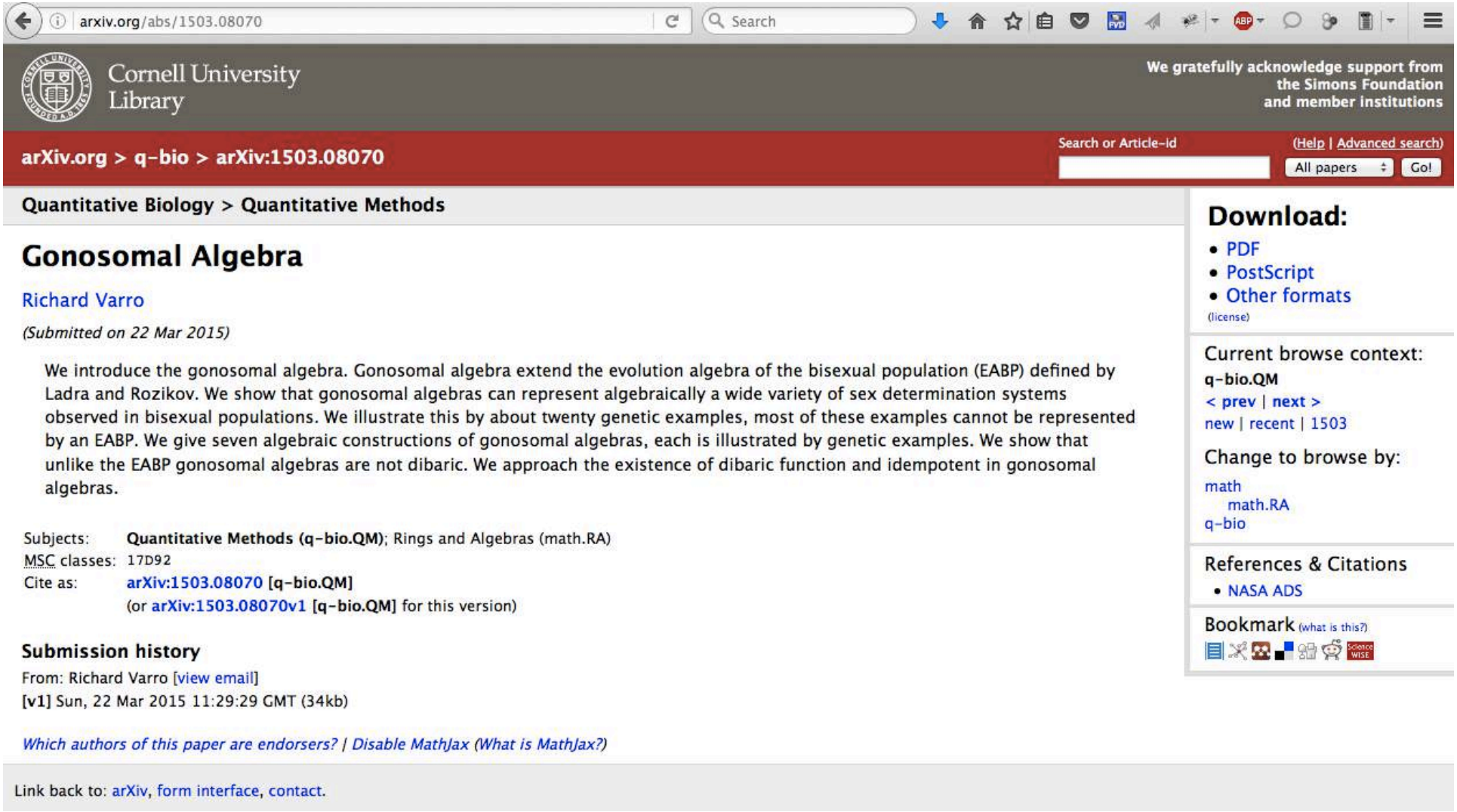

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Richard Varro

(Submitted on 22 Mar 2015)

We introduce the gonosomal algebra. Gonosomal algebra extend the evolution algebra of the bisexual population (EABP) defined by Ladra and Rozikov. We show that gonosomal algebras can represent algebraically a wide variety of sex determination systems observed in bisexual populations. We illustrate this by about twenty genetic examples, most of these examples cannot be represented by an EABP. We give seven algebraic constructions of gonosomal algebras, each is illustrated by genetic examples. We show that unlike the EABP gonosomal algebras are not dibaric. We approach the existence of dibaric function and idempotent in gonosomal algebras.

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