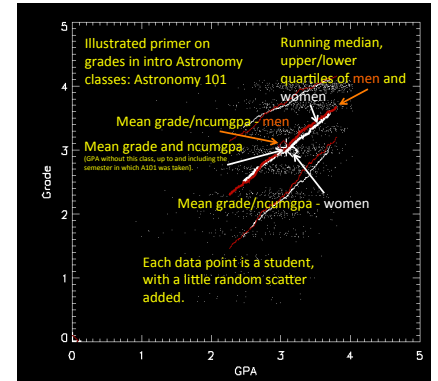


# Student grades in introductory astronomy courses :

- sex-dependent grade disparities are widespread
- no strong correlation with instructor or class quality

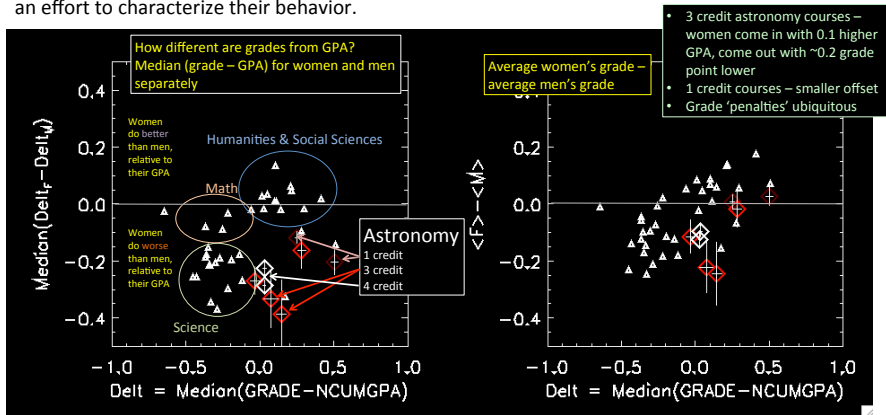
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## Context

Many large science classes on campus give out grades that are both lower than those usually received by students (i.e., they are 'hard') and give out grades for women that are ~0.3 grade points lower than men (i.e., they have a 'grade penalty'). The latter is neither pleasant to think about nor is clearly understood.

I have analyzed 20 years (1992-2012) of Introductory Astronomy classes for non-science majors in an effort to characterize their behavior.



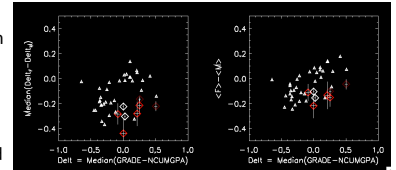
## Amusing aside

I was pretty worried about the effect of grades saturating at 4.0, and the effect this has on sex-dependent grade offsets. Imagine I invented a class where 1/2 the class gets an A (I did - oops - astronomy 106, the 1 credit mini-course, along with Ted Bergin). I could still have sex-dependent offset in my score distribution but it gets much smaller because so many people get 4.0s. I investigated this with a mock dataset, where I construct grades with the following rule :

$$\text{grade} = \text{GPA} + 0.65(\text{Normal distribution}) + \text{Delt} \quad (-0.3 \text{ if a woman, sorry})$$

Then the grades are quantized. The panel below shows what comes out of this analysis in about 1/4 of the random draws.

There is a roughly 25% chance that a correlation as strong as the one we see between grade penalty and 'difficulty' comes from an intrinsically uncorrelated dataset.



## Discussion

- Introductory Astronomy for non science major classes give out **grades that are approximately consistent with their overall GPA**
  - Consistent with Earth Sci (classes for non-science majors less challenging).
  - Grades vary significantly from semester to semester
    - Student learning or instructor preference or both?
  - 1 credit mini-courses give out substantially higher grades.
- All 3 & 4 credit Astronomy classes (and arguably the 1 credit ones) are consistent with a grade penalty of 0.3 grade
  - **women come in with typically a 0.1 higher GPA than men, and get 0.2 grade point lower.** - this is Astronomy-wide, not just some classes
- Grades saturating at A mean that high-scoring courses partly mask sex-disparities
  - speculation - does this contribute to the more modest men's grade penalty for humanities classes?
- Modest class sizes and the uncontrolled variables of teaching, learning, assessment and evaluation limit sensitivity to search for trends in grade penalty with class or instructor to ~0.1 grade point
- **No variations in grade penalty with instructor or classroom circumstances**
  - Q1-Q4, male or female instructors, or 30:70 to 50:50 F:M ratio in class.
  - Grade penalty either complicated, or poorly measured but robust to Astronomy classroom circumstances

