Better (?) ingredients → better Pizza !?

All models are different (if not wrong) !?!

Uncertainties of Age Estimation of Spiral Galaxies
Using Optical and Near-Infrared Photometry (Tuesday)

alpha-Enhanced (at given [Fe/H]) Integrated Lick/IDS
Spectral Indices + SBF (Thursday)
ON THE AGE AND METALLICITY ESTIMATION OF SPIRAL GALAXIES
USINGOPTICAL AND NEAR-INFRARED PHOTOMETRY

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ABSTRACT

In integrated-light, some color-color diagrams that use optical and near-infrared photometry show surprisingly orthogonal grids as age and metallicity are varied, and they are coming into common usage for estimating the average age and metallicity of spiral galaxies. In this paper we reconstruct these composite grids using simple stellar population models from several groups convolved with exponentially decaying star formation histories. We find that the youngest populations present \( t < 2 \) Gyr dominate the light, and because of their presence the age-metallcity degeneracy can be partially broken with broad-band colors, unlike older populations. There are several major problems, however. First, since the young populations dominate, it is the (nearly) present-day abundance that is being measured, not the mass-weighted abundance, despite the fact that the grids are usually labeled by mass-weighted ages. Second, there is large scatter among the various models, with substantial zero point and slope offsets such that knowing the abundance or age to 0.2 dex precision appears impossible with present models. The dominant uncertainties arise from convective core overshoot assumptions and the treatment of the thermally pulsing asymptotic giant branch phase, but helium abundance may play a significant role at higher metallicities. Finally, real spiral galaxies are unlikely to have smooth, exponential star formation histories, and burstiness will cause a partial reversion to the single-burst case, which has even larger model-to-model scatter.
The stellar populations of spiral galaxies

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Abstract

We have used a large sample of low-inclination spiral galaxies with radially resolved optical and near-infrared photometry to investigate trends in star formation history with radius as a function of galaxy structural parameters. A maximum-likelihood method was used to match all the available photometry of our sample to the colours predicted by stellar population synthesis models. The use of simplistic star formation histories, uncertainties in the stellar population models and considering the importance of dust all compromise the absolute ages and metallicities derived in this work; however, our conclusions are robust in a relative sense. We find that most spiral galaxies have stellar population gradients, in the sense that their inner regions are older and more metal rich than their outer regions. Our main conclusion is that the surface density of a galaxy drives its star formation history, perhaps through a local density dependence in the star formation law. The mass of a galaxy is a less important parameter; the age of a galaxy is relatively unaffected by its mass; however, the metallicity of galaxies depends on both surface density and mass. This suggests that galaxy-mass-dependent feedback is an important process in the chemical evolution of galaxies. In addition, there is significant cosmic scatter suggesting that mass and density may not be the only parameters affecting the star formation history of a galaxy.
STRUCTURE OF DISK-DOMINATED GALAXIES. II. COLOR GRADIENTS AND STELLAR POPULATION MODELS

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ABSTRACT

We investigate optical and near-IR color gradients in a sample of 172 low-inclination galaxies spanning Hubble types S0–Irr. The colors are compared with stellar population synthesis models from which luminosity-weighted average ages and metallicities are determined. We explore the effects of different underlying star formation histories and additional bursts of star formation. Our results are robust in a relative sense under the assumption that our galaxies shared a similar underlying star formation history and that no bursts involving more than ~10% of the galaxy mass have occurred in the past 1–2 Gyr. Because the observed gradients show radial structure, we measure “inner” and “outer” disk age and metallicity gradients. Trends in age and metallicity and their gradients are explored as a function of Hubble type, rotational velocity, total near-IR galaxy magnitude,
Fig. 11.—Near-IR–optical color-color plots separated by rotational velocity, $V_{\text{rot}}$ (km s$^{-1}$), for the BdJ00 sample. Galaxy center point types correspond to the level of nuclear activity in the galaxies (trends with colors and their gradients with nuclear activity were looked for but none were found, possibly because of small statistics).
Figure 4 – Time evolution for the exponential (eq. 10) upper panel) and Sandage (eq. 11) lower panel) star formation histories (solid curves). The dotted curve is a Sandage-style burst of star formation in which 10% of the total mass of stars are formed. See Fig. 7 for the effect of such a burst on the population metallicity.
Fig. 10.— Similar to Figure 9, but a chemical enrichment scheme with a monotonic age-metallicity relation is incorporated in the BC03 composite stellar population models at given average ages (see text).
Fig. 5.— Same as Figure 4, but our computations using the Teramo-sss and Teramo-sso isochrones without TP-AGB phases are shown as dashed and dotted lines, respectively. At 1 Gyr and solar metallicity, for the Teramo-sss isochrones, the TP-AGB and the overshooting effects are depicted with vectors.
Fig. 7.— Similar to Figure 4, but solid lines with crosses are from M05. BC03’s and M05’s metallicities are indicated at the bottom right. At 100 Myr, M05 are only given at \( [\text{Z/H}] = -1.35, -0.33, 0.00, \) and 0.35. Here observational data of LMC, Milky Way, and M31 star clusters and of elliptical galaxies are overlaid. LMC star clusters’ integrated colors are from van den Bergh (1981), Persson et al. (1983), and Frogel et al. (1990). That of Milky Way and M31 star clusters are from Burstein et al. (1984) and that of elliptical galaxies are from Peletier (1989).
Fig. 6.— Similar to Figure 4, but solid lines with open diamonds are from ML03 and dotted lines with open circles are our computations using Padova00 (P00) isochrones, respectively. Note that the super-solar metallicity of BC03 and ML03 is $Z = 0.05$ from Padova94, while that of P00 is $Z = 0.03$. 