

IGM@50

**Is the Intergalactic Medium
driving Star Formation?**

Scientific Organizing
Committee

*Andreas Burkert
Edvige Corbelli
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Bruce Elmegreen
Debra Elmegreen
Francesco Palla
Xavier Prochaska*

LOC
Edvige & Francesco



**Abbazia di Spineto
Siena, Italy**

June 8-12 2015

www.arcetri.astro.it/igm50

Spineto-Arcetri



2004

2007

2009

2012

2015

INAF/ARCETRI---SPINETO

IMF@50

*HI Survival
through
Cosmic Times*

SFR@50

*Metals in
Tuscany*

IGM@50

LOC

Edvige & Francesco

LOC

Edvige, Raffaella, Simone

LOC

Edvige & Francesco, Filippo

LOC

Filippo & Giovanni

LOC

Edvige & Francesco

IMF@50

The Initial Mass Function
50 years later



SFR@50

Filling the Cosmos with Stars

Abbazia di Spineto (Italy), July 6-10, 2009



TOPICS

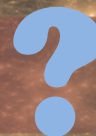
- Star formation laws at early cosmic times
- Observations of pre-spiral disks
- Gas conditions at high-z
- Numerical simulations of star forming disks
- Star formation rate tracers in local galaxies
- Empirical relations between SFR and the gas
- Physical origin of the Schmidt law
- Star formation rates in the Milky Way
- The subgrid physics in molecular clouds
- Star formation in extreme conditions and thresholds

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Is the Intergalactic Medium
driving Star Formation?

Cosmic web flows into galaxies
Disk growth across cosmic time
The evolution of star formation in galaxies



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Graphic Design: Roberto Baglioni

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Key astrophysical topics,
unrelated to our research field

IMF@50: mass

THE INITIAL MASS FUNCTION 50 YEARS LATER

Hans



STARS ARE SIMPLE: LIFETIME,
LUMINOSITY, END PRODUCTS... DEPEND
ON THEIR INITIAL MASS

1954-2004

IMF@50

WHICH INITIAL MASS FUNCTION, WHY?
ENVIRONMENT: IS IT UNIVERSAL TODAY?
TIME: DOES IT CHANGE WITH COSMIC TIME?
TRIGGER: FRAGMENTATION/ACCRETION
DRIVERS ?

GALAXIES ARE NOT BEING BORN TODAY:

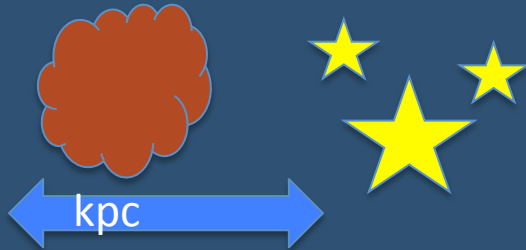
AS FOR STARS AND LIVING BEINGS, THEY GO THROUGH A GROWING PHASE, AN
ACTIVE PHASE, AND AN AGING PHASE

BUT THE DIVIDING LINES ARE NOT SO CLEAR YET...

SFR@50: Filling

FILLING THE COSMOS WITH STARS

RK



GALAXIES SHINE BECAUSE THEY
MAKE STARS OUT OF GAS:

THEIR LUMINOSITY DEPENDS ON SFR,
THE K-S LAW RELATES THIS TO THE GAS
INSIDE THEM

1959-2009

SFR@50

WHICH SFR INDICATOR, K-S INDEX, WHY ?
ENVIRONMENT: IS SF EFFICIENCY UNIVERSAL ?
TIME: WHICH TIMESCALE AND TRACERS ?
TRIGGER: AT WHICH SCALE ? H_{TOT} , H_2 ?

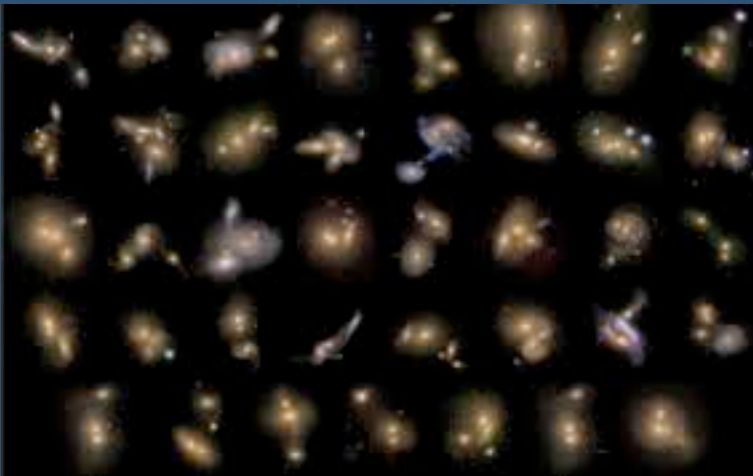
2009-2015: K-S + SFR-STELLAR MASS

IS SFR DRIVEN BY MASS DURING ACTIVE PHASE?

HOW LONG DOES THE ACTIVE PHASE LAST? IS IT MASS DEPENDENT?

HOW, WHEN DO ACCRETION AND FEEDBACK REGULATE GALAXY MASS?

HOW DO GALAXIES GROW ?

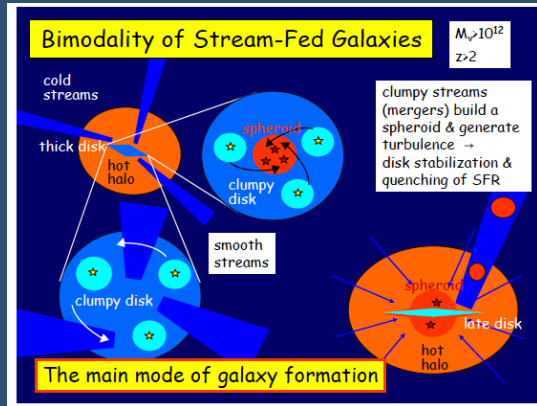


MERGERS



IGM FEEDING

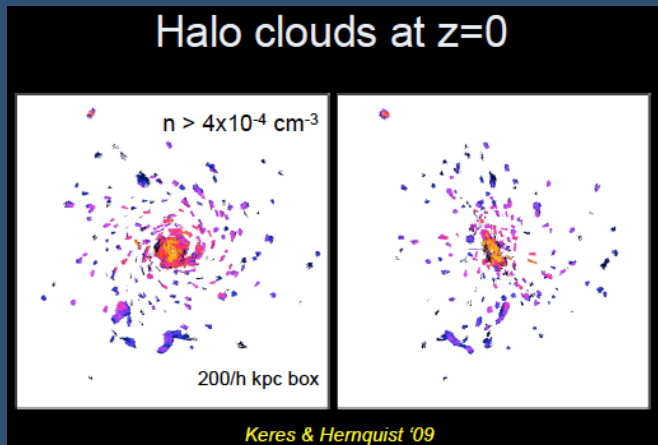
IGM@50 precursor's talks (at SFR@50)



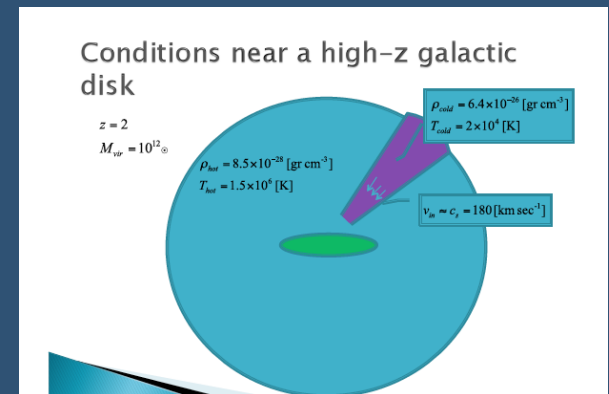
Avishai Dekel - Cold streams, Clumpy disks and Compact Spheroids



Xavier Prochaska - On the non-evolution of HI disks over Cosmic Time



Dusan Keres- What drives the Cosmic Star Formation history?



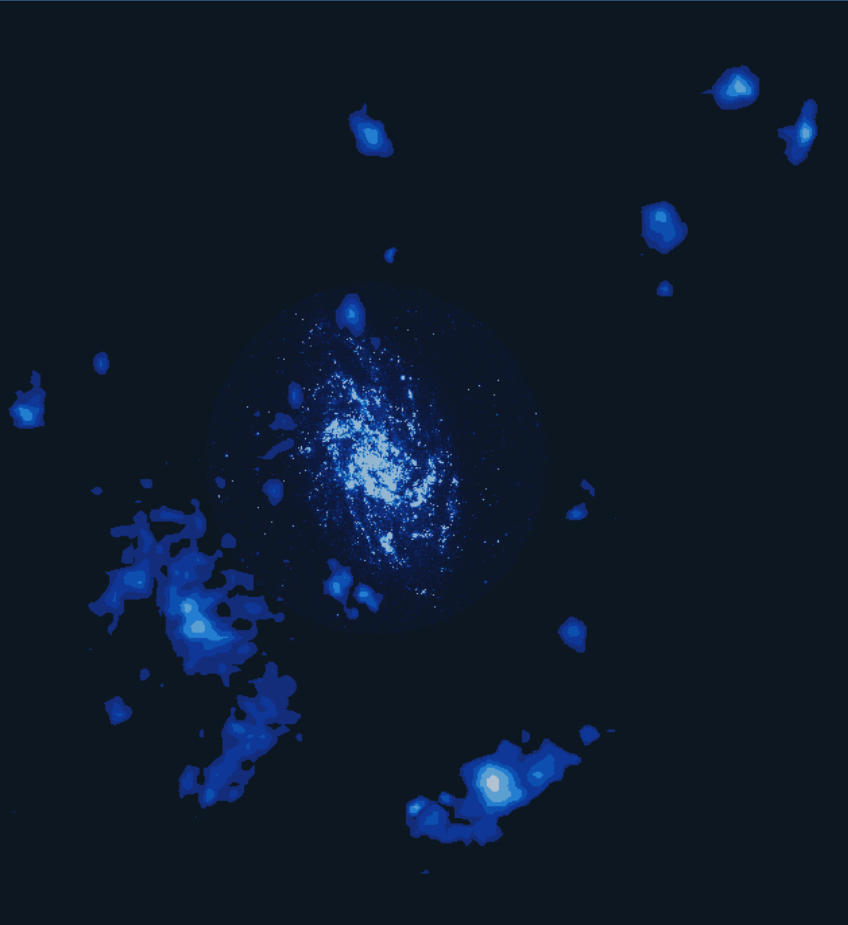
Yuval Birnboim- Getting the gas to where we need it the most

GALAXIES : connected to environment

M33: the anti-Andi's theory

*M33, A LG DISK GALAXIES
WITH NO RECENT MERGERS*

*M33 will die soon,
you can already see
the tidally stripped
gas around it*



- THE M31-M33 INTERACTION
PICTURE IS INCONSISTENT
WITH PROPER MOTION AND LG
PLANES

(van der Mariel et al. 2012; Shaya & Tully 2013)

- M33 IS APPROACHING LG
NOW AND AND GIVEN ITS DM
MASS CLOUDS MIGHT BE THE
NEUTRAL SIDE OF IGM
FUELING SF

-M33 HAS LOW BARYONIC
FRACTION =>FEEDBACK

-BURKERT'S HALO FAILS

Avishai's comment on former title:

*IGM@50: IS THE INTERGALACTIC MEDIUM **FEEDING** STAR FORMATION ?*

Of course it does
Where else would
the gas come from?
The question is how
and if

*IS THE INTERGALACTIC MEDIUM **DRIVING** STAR FORMATION ?*

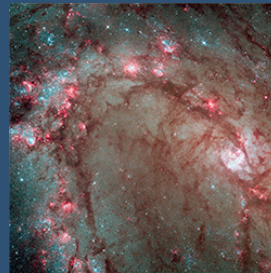
*-HOW CAN THE PHYSICS OF LARGE SCALE STRUCTURES AFFECT THE FORMATION
OF MOLECULAR CLOUDS AND GAS COLLAPSE ON MUCH SMALLER SCALES ?
- WHICH IS THE OBSERVATIONAL EVIDENCE?*

*-HOW DOES THE ACCRETED GAS PROPAGATE TO SF SITES?
-WHICH INTERNAL PROCESSES AFFECT FEEDING, FEEDBACK AND MASS LOSS?
-IS THE WEB RESPONSIBLE OF MORPHOLOGY AND METALLICITY DIFFERENCES ?
-DOES THE LIFETIME OF A DWARF DIFFER FROM THAT OF A MASSIVE GALAXY ?*

IGM@50: driving

IS THE IGM DRIVING STAR FORMATION?

Andi



1965-2015

IGM@50

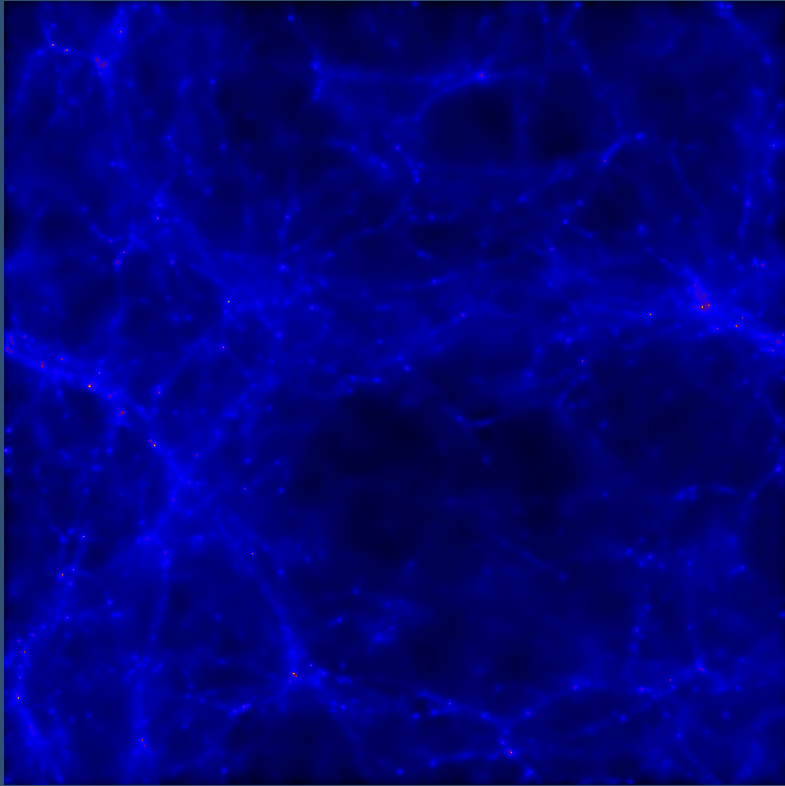
IS THE IGM DRIVING GALAXY EVOLUTION ?

ENVIRONMENT: IN GROUPS, CLUSTERS?

TIME: AT WHICH COSMIC TIME? IS IT EPISODIC?

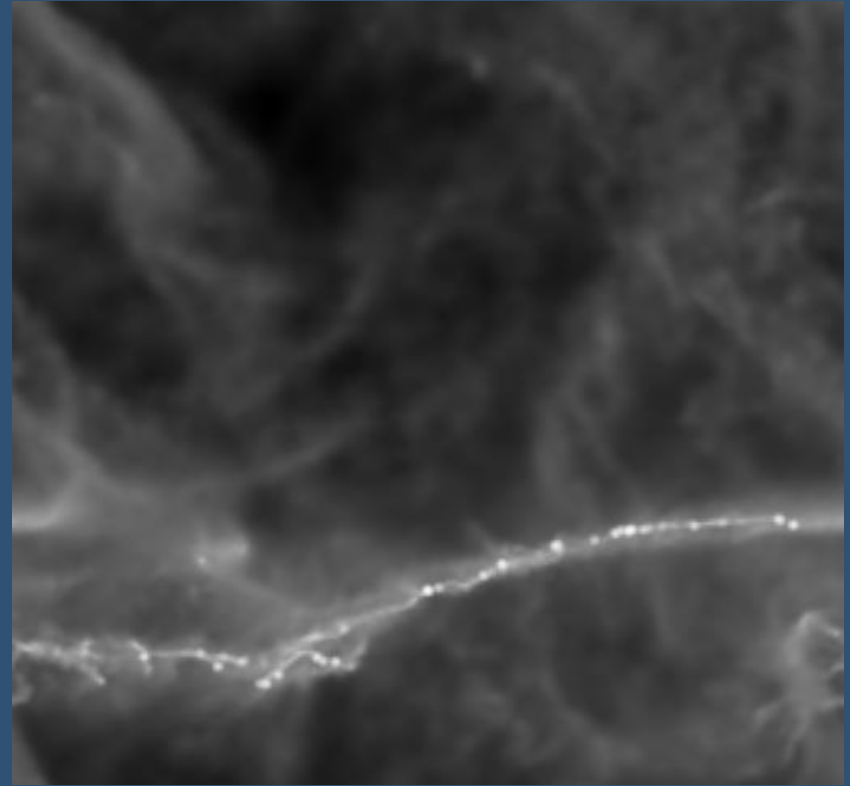
TRIGGER: GALAXY MASS? INTERNAL FEEDBACK?

Filaments everywhere !



1 co-moving Mpc

Cosmological Context



10 pc

Star Formation Context



Miro' - Pollock - Sam Francis

WEB-site and graphic designer : Roberto Baglioni (UNIFI)



IGM@50

PLANNING

Following a galaxy lifetime

Mon.

- ① THE COSMIC WEB: HISTORY AND PROPERTIES
- ② PREDICTIONS FOR COLD STREAMS
- ③ DETECTING COLD STREAMS
- ④ FEEDBACK 1 & GALAXY GROWTH
- ⑤ EVIDENCE OF GAS ACCRETION INTO GALAXIES
- ⑥ SCALING RELATIONS IN GALAXY ACTIVE PHASE
- ⑦ FEEDBACK 2 & THE CGM DOWN TO $z=0$
- ⑧ QUENCHING STAR FORMATION

Fri.

2004-
2015



Spineto@11

IS IT WORTH THE EFFORT OF ORGANIZING IT ?

ENVIRONMENT:

IT DOES MATTER (PLACE+LOCALS, SOC, LOC)

TIME:

IS IT EPISODIC? IT NEEDS TO

TRIGGER:

YOUR FEEDBACK !!

**We always leave this place with the wish to have
spent a little more time outside this room....**

IS IT WORTH YOUR EFFORT OF BEING HERE?

-WE HOPE SO !

*-THANK YOU TO THOSE OF YOU WHO ARE
HERE FOR THE 3RD , 2ND TIME!*

*-THANK YOU TO NEWCOMERS, YOU CAN
BE IN THE NEXT ...@50!*



Enjoy Spineto 2015!

AND THANKS TO THOSE WHO WILL PROVIDE PICTURES!

