PHYS 5326 – Lecture #19

Monday, Apr. 23, 2007
Dr. Jae Yu

- Higgs Search Strategy
- Higgs Search Channels
- Backgrounds to Higgs Searches
- Requirement on Experiments for Higgs Searches

Announcements

- Homeworks
  - Please be sure to submit all yet-to-be-submitted homework by Monday, May 7
- Project presentations
  - Will have 20+10 min presentation each in the class, Wednesday, May 2
- Project reports
  - Must be submitted by Monday, May 7

Write Up Requirements and Evaluation

- Due date: 1pm, Monday, May 7 to CPB342
- Requirements
  - Professionally prepared in MS words
    - No spelling or grammar mistakes
    - The style of the write up should be unified so that it looks like written by one person
  - All contents on the template and more should be contained in the write up
  - Plots, diagrams and photos should be added w/ appropriate figure captions numbered in order of appearance. The captions should go at the bottom of the figure.
  - References must be indicated throughout the text in order of appearance. They must be properly matched in the list of bibliography at the end of the document.
  - Tables must be added and numbered in order of appearance. The caption should go on top of the table.
- Key evaluation points
  - Quality of the document including the quality of the result– 50%
  - Content and organization of the document – 10 %
  - Satisfaction of the above requirements – 15%
  - Thoughtfulness, usefulness and relevance of contents of the document – 25%

Presentation Requirements

- Requirements
  - Professionally prepared using power points
    - Need your presentations 30 min prior to the class via e-mail
  - Each presentation must be 23min (presentation) + 7min (question and answer)
  - Must have the following components:
    - General Introduction
    - Motivation
    - Apparatus
    - Data analysis and samples
    - Backgrounds and their estimate
    - Results, including uncertainties
    - Conclusions and prospects
- Key evaluation points – 25% each
  - Quality of results included in the slides
  - Content and organization of the slides
  - Knowledge on presentation material – answers to questions
  - Manner of presentation

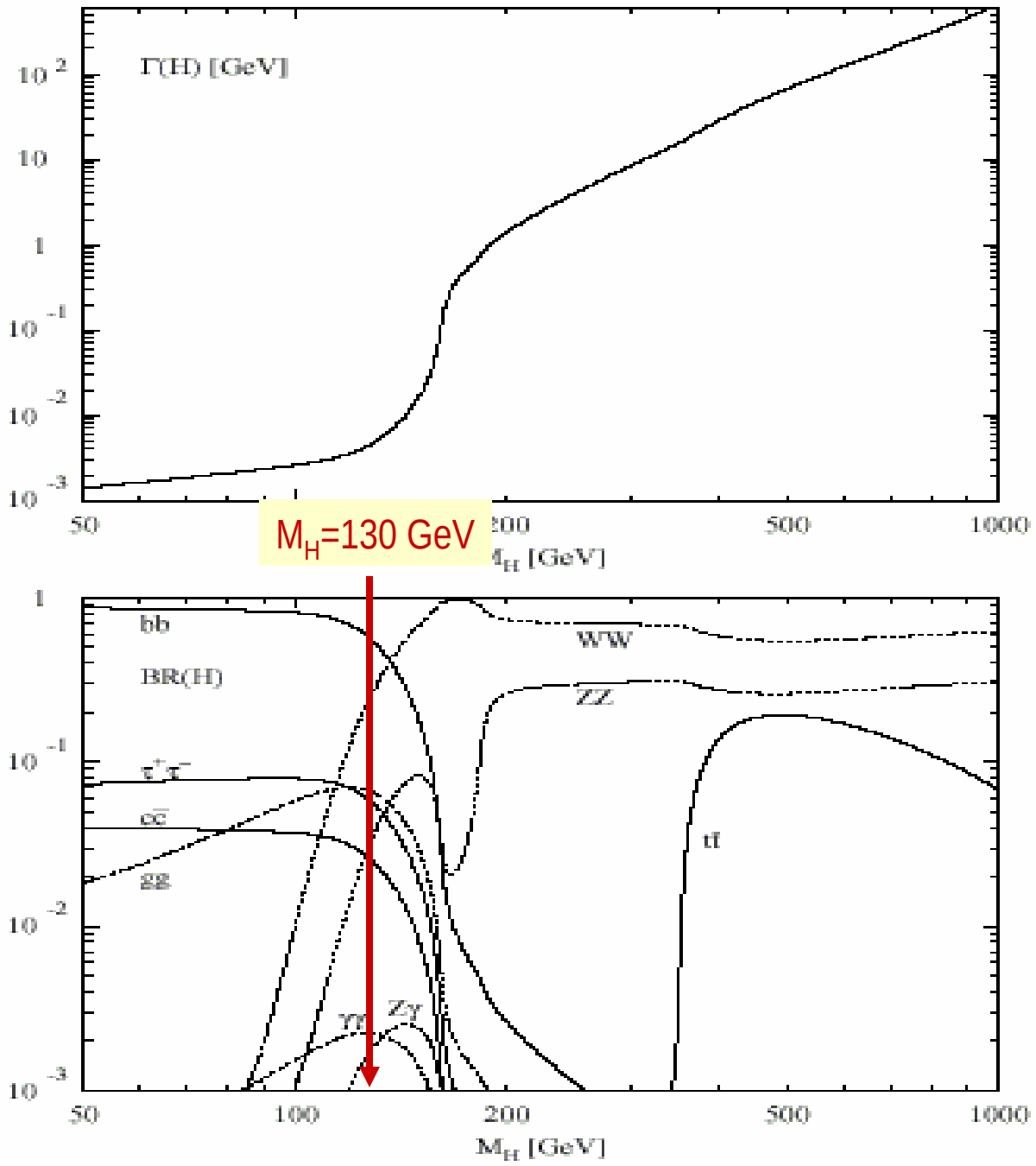
Higgs Particles

- What are the Higgs particles we are looking for?
  - Standard Model Higgs: Single neutral scalar
  - MSSM Higgs: Five scalar and pseudoscalar particles
    - h^0, H^0, $H^{+/-}$ and A^0
  - Higgs in Other Models
- What are the most distinct characteristics of Higgs particles?
  - In both SM and MSSM, the Higgs particles interact with fermions through Yukawa coupling whose strength mostly is set by the fermion masses.

Search Strategy

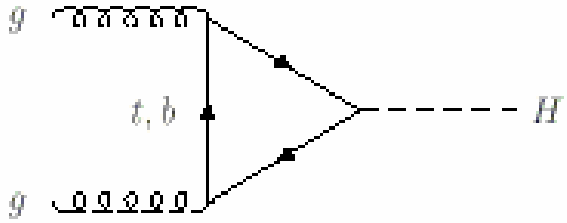
- What are the best ways of discovering Higgs?
  - Make assumptions in Higgs mass
  - Study the branching ratios
    - Study the most identifiable final states
  - Choose the channels w/ smallest background
  - Study ways to increase number of recorded Higgs
    - Accelerator dependent
    - Smarter triggers
  - Identify and Implement detector improvements that are needed
- Precision measurements for Higgs properties
  - To distinguish SM and SUSY model Higgs

SM Higgs Branching Ratios



Higgs Production Processes at Hadron Colliders

Gluon fusion: $gg \rightarrow H$



WW, ZZ Fusion: $W^+W^-, ZZ \rightarrow H$

Higgs-strahlung off W,Z: $q\bar{q} \rightarrow W^*, Z^* \rightarrow W, Z + H$

Higgs Bremsstrahlung off top: $q\bar{q}, gg \rightarrow t\bar{t} + H$

Hadron Collider SM Higgs Production σ